AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 2, No. 17.] NEW YORK, SATURDAY, AUGUST 30, 1879. [$3.00 per Annum. SINGLE COPIES, 6 CENTS.

The Casting of Small Steam Cylinders.

BY V. HOOK.

It is a difficult matter to cast perfectly a small cast-iron cylinder. The difficulty *always* lies in the moving of the port cores, due to the buoyant effect and force of the metal entering the mold. The writer has put up a 2½ x 5 in. cylinder *seven* times, and then only in part succeeded in getting a good one. The entire difficulty resulting from attempting to keep the port cores in place in shallow prints on the valve seat, there being an individual print for each core. A great many foundry foremen will not touch a small cylinder with separate steam-port core prints, as they have time and time again experienced the difficulty I speak of, and only succeeded in keeping the port cores in place by anchoring them with half a pound of nails, and last but not least, to have the machinist tell them the casting is too hard in spots; due, of course, to the chilling around the nails. Small cylinders are also very apt to be "dirty."

The writer, in his life, has had a great many small cylinders to make, and, experiencing the troubles mentioned, studied up the plan here presented, and has never had any trouble since adopting it. In fact, the moulding and casting of a small cylinder by this plan is a pleasure. The plan consists in forming on the valve seat of the pattern *one* large print instead of *three* separate ones. This print is somewhat larger than the seat and ought to be nearly as deep. The port cores are made as usual in a box and pasted into the recesses of another which fits the valve seat print. This core is shown in section at a, Fig. 3, and should be deeper than shown to give it solidity in the print. Fig. 4 is a face view of this core. Fig. 1 is a side view of the steam port core in section, a, a, a, a, etc., are the ends of short wires (shown in elevation at a, a, Fig. 2) to prevent the vent strings A. B. from cutting through the corners when withdrawn. C C in Fig. 2 shows their strings, and b, b, b, the stiffening wires. The extent of the wiring and venting of course depend on the size of the core. The writer has tried the plan of forming the three port cores, and the one into which they are pasted in one; but prefers making them in separate boxes, and pasting them in—less trouble arising. When they are pasted in they should be well "blacked." Blacklead, charcoal and glue, or finely pounded coke dust and charcoal and glue forming a good blacking which will leave smooth holes. The cylinder is moulded and cast valve seat down, the vent from the port cores being taken off at a, a, a, Fig. 3, down through the drag and out at the bottom board. The vent holes left at the upper ends D, D, of the port cores, by the vent strings, should be stopped off to prevent the metal entering the vents. The surface at I, I, of the port cores is joined by the box to fit either up against or into recesses in the central core, which in either case should just touch them, unless the plan of pasting the port cores also into the large central core is adjusted. Cylinders, up to ten inches bore, may be successfully cast in green sand, clean and solid. The mold should not be blacked or slicked. Shrink heads should be placed on each flange.

Fig. 1

Fig. 3

Fig. 4

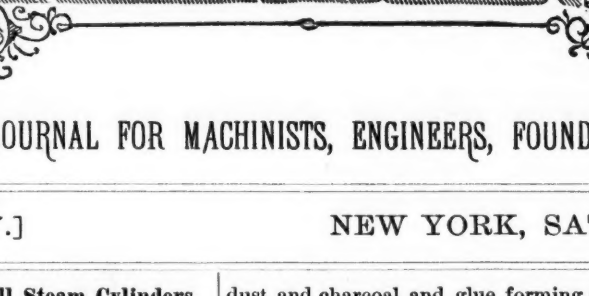


Fig. 2

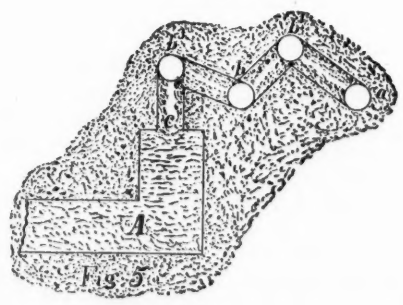


Fig. 5

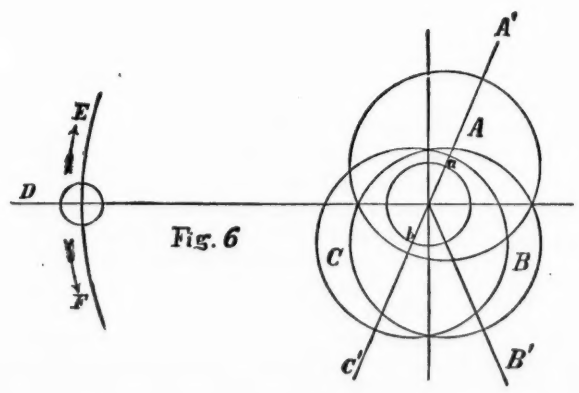


Fig. 6

A machinist, who was in my employ at one time, stopped me the other day, saying he had got "stuck" on a job. He had been overhauling an engine in a manufactory, and owing to certain changes, it was necessary to run the engine in the opposite direction. Being a trifle at sea on this part of the change, he consulted Roper's "Hand book on Land and Marine Engines," when on page 131 he found the following:—"How to reverse an engine. * * With a cold chisel or center punch, make a mark on the engine shaft, and make a corresponding one on the side of the eccentric at the same point. , Place one point of an outside calipers on the mark on the shaft, and with the other point find the center of the shaft; here, also make a mark. Now move the eccentric round on the shaft in the direction in which the engine is desired to run, until the mark on the hub of the eccentric is brought parallel with the last mark made on the shaft, then make the eccentric fast, and the engine will move in the opposite direction from which it did before the eccentric was moved." He followed these directions, found the new position, and cut the key seat, and the result according to his way of expressing it was, "she didn't reverse worth a d—m." I drew a little sketch, (Fig. 6), and as the engine ran as per arrow E., D. being the crank-pin, and the valve stem being coupled direct to the eccentric rod, A was the position of the eccentric. He placed one leg of the calipers at a, (first mark) and with the other found the point b directly opposite, or the center as per directions, marked it and moved the eccentric from mark a, to correspond with mark b. Of course the engine wouldn't run, the eccentric being just twice the lap and lead out: C being the position of the eccentric then, and C′ its center line. It is plain that the correct position of eccentric to run opposite, or in the direction of arrow F is B, B¹ its center line. A simple way, "by the way" of getting at the position of the eccentric to run in an opposite direction, when the chest cover cannot easily be removed, is to put the engine on the center, make a mark on the valve stem flush with the gland, and turn the eccentric till this mark reappears at the same position. Of course the correctness of the new position depends on that of the old.

Why is it that Mr. Roper should write, and let go uncorrected, so unpardonable a mistake? Of what good is his 30 years of experience (?) to himself or any of his readers, when the result in so small a matter as the position of an eccentric, ends in a wrongly located key-seat for an eccentric and profanity *ad libitum*.

One unmistakable indication of the estimation in which the AMERICAN MACHINIST is held is the steady and increasing demand for back numbers through the news trade, and from subscribers, proving that the articles contained in it are of permanent value to practical men. We receive frequent calls for all the numbers thus far published, and for Monitor binders, which is a very clear evidence that the paper is not only read, but carefully preserved for future reference.

This is our twenty-ninth issue, and a file of the AMERICAN MACHINIST from the commencement forms a very convenient and useful machinists' library. We shall hereafter publish an index at the end of every volume.

New Double Cylinder Steam Fire Engine.

We present on this page an illustration of the Double Cylinder Steam Fire Engine, manufactured by the Clapp & Jones Manufacturing Company, of Hudson, N. Y.

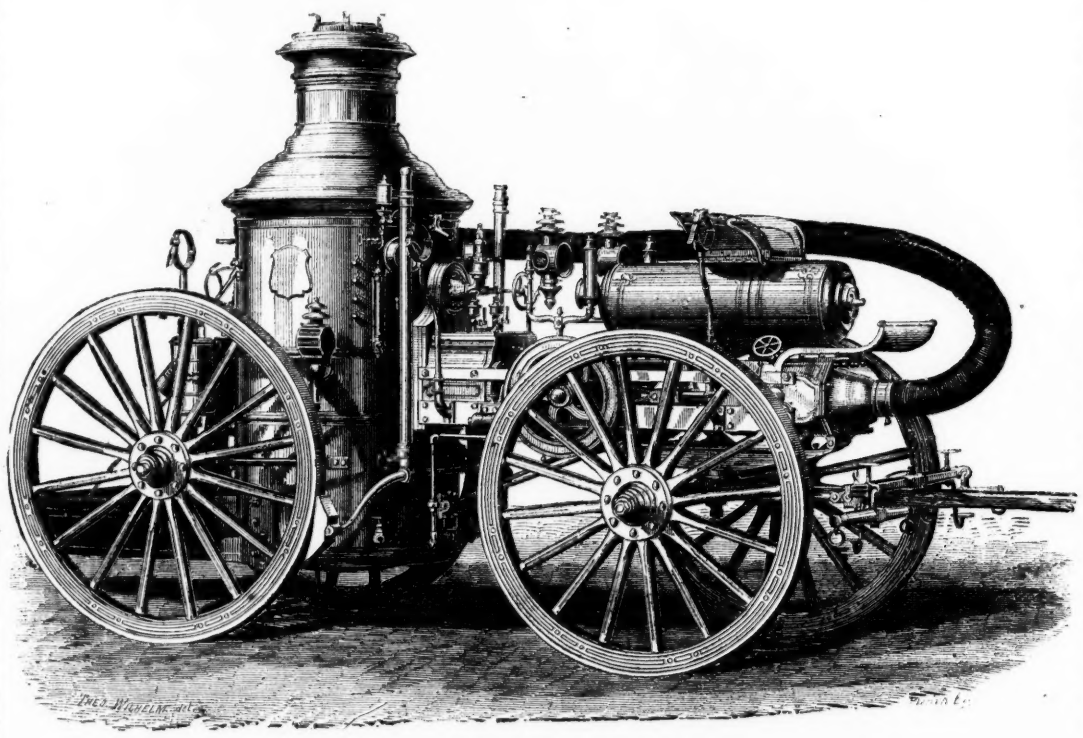
The pump is of novel construction, and is so arranged that by taking off the heads (which can be done in less than ten minutes), the valves are taken out at the same time, making it very convenient for repairs or cleaning out, if either is required. The arrangements and proportions are such, and the displacement by the plunger so large in proportion to the space at the ends of the pump, that water can be lifted to a very great height. The pump is made entirely of composition (copper and tin), with no iron parts to rust, and is so constructed as to require no leather packing or springs. By introducing the water in the center of the front head, there is the advantage of an equal distribution of the water through the annular space to all sides of the pump cylinder and valve chambers, making a very free water course to the valves. The pump is double acting, and both ends are alike, so that the valves from one end will fit perfectly in the other.

The boiler has great steaming capacity, and is provided with a peculiar arrangement for the circulation of the water, which is of the highest importance in boilers that operate so quickly, and are required to make so much steam in so small a space as is necessary in steam fire engines. The boiler is so constructed that every part can easily be reached in case repairs are needed. These boilers are claimed to bear the strongest firing without the least danger of overheating, and to make all the steam that can be used, working with an open throttle while doing the hardest possible work.

These engines are so arranged that the center line of pressure comes in the center of the frame work, giving the greatest strength with the least weight of material. The whole construction of the engine is simple, therefore they are not liable to get out of repair, and do not require an engineer so well skilled as more complicated machines.

According to the official report of the very thorough trial of steam fire engines at the Centennial (lasting four days), this engine made the best record. On page 279 of this report we find the following, viz.:

"Clapp & Jones' engines, Nos. 7 and 11, made the best record, and were the only ones, except Nos. 2 and 6, that went through all the trials without an accident sufficiently serious to interrupt their regular work. These (Nos. 7 and 11) are, in most respects, the strongest engines and the most perfect in detail and finish. It is also quite clear that No. 7 is superior to all others in nearly every point that concerns the making up of a good steam fire engine."



DOUBLE CYLINDER STEAM FIRE ENGINE.

Automatic, Versus Fixed Cut-Offs.

BY F. F. HEMENWAY.

A recent writer on this subject characterizes the automatic cut-off engine as "a folly and a fallacy." "A fortified popular delusion sufficiently great to be a national loss and disgrace." The writer lays down the proposition that "the economic point of cut-off is an unvarying point in all ordinary engines, and nearly so in all engines." This point he fixes without reference to conditions at ¼ stroke. His conclusions that 1½ atmospheres is the most economical pressure for condensing engines, and that "there is no gain by attaching a condenser to a true high-pressure engine, but generally there is a loss," are certainly at variance with nearly all modern practice. Leaving these for the present the automatic cut-off is fair ground for discussion, especially since this writer does not profess to have arrived at his conclusions through actual experimental knowledge. The horizontal automatic cut-off engine may be said to be the typical engine of this country. It has certainly passed beyond the qualities of a novelty. It may better be said, it is the settled conviction of twenty years' experience. If it is a "disgrace" it certainly is a "national disgrace," since the question is not, Where in the country is it used? but rather, Where in the country is its use not common? In this we have set an example that the older countries are following to such an extent that we may soon be following them. Common as is its use, it possesses one quality which is not possessed by any other cut-off, but which is always ignored by those opposed to its use. This quality may be defined as its capability to take care of a large *temporary* increase of load, whereby the necessity for the use of a large cylinder is obviated. Admitting that the ¼ cut-off is the best in point of economy, (not that we believe it so demonstrated, but to get on common ground), if we have such exact construction and condition of engine, load, and steam pressure coupled with the ¼ cut-off, as to present at all times a perfect equilibrium, it would need no demonstration that the fixed cut-off—being equal in action, was equal in efficiency to the automatic. In fact, the latter operating through the principles of its construction would become to all intents "fixed," and hence the exact mechanical equivalent of the former. Unfortunately, however desirable such a condition might be, it is precisely what does *not* obtain in practice. Practically speaking, two of these elements, viz., work and steam pressure, are fluctuating quantities. Manifestly, either suffering a change disturbs the equilibrium, and something must be done to restore harmony. Just here the vital difference in the two systems becomes apparent. If we use the fixed cut-off we must wire-draw the steam in a greater or less degree to effect this harmony. If, on the other hand, we use the automatic cut-off, we effect a corresponding harmony by admitting steam for a longer or shorter proportion of the piston stroke. The fundamental principles of the two systems being so plain we ought to be able to trace the effects of their practice. The engineer in designing or recommending a steam engine for any specific service, first ascertains the work required of the engine. He will, in the great majority of cases, be able to determine with reasonable exactness what this will be for perhaps nine-tenths of the time, but he must provide for doing more work for the balance, say one-tenth of the time. Perhaps there is a long line of shafting to be started up promptly on cold mornings; an elevator to be run for a few minutes during the day; some extra machinery which is only occasionally used, or a foundry blower to be run for an hour or two once or twice a week. Let it be whichever of these it may, or something else, in nine cases out of every ten he must provide for doing in an emergency at least 30 per cent. more than the ordinary work. Of course, he has based his calculations upon a certain boiler pressure, and while he can rely upon this for a very large proportion of the time, fires must be cleaned and a little carelessness allowed for, and occasionally the 75 pound steam gets down to 60 pounds. But he must provide for doing all the work with this decreased pressure. If he proposes to use the fixed cut-off at ¼ stroke the cylinder capacity must be increased 60 per cent; that is he must permanently make the cylinder 60 per cent. larger than he wants, to meet temporary conditions existing perhaps one-tenth of the time. As previously remarked, the automatic cut-off provides for this temporary increase of load and decrease of pressure, permitting the use of a cylinder best proportioned for the general work. The result would be the fixed cut-off would work at its best economy one-tenth of the time, and the automatic nine-tenths, while from the unavoidable dis-proportion existing in the former, its best economy would hardly equal the poorest economy of the latter. Since the piston of the fixed cut-off cylinder is constantly doing 60 per cent. more useless work against the pressure of the atmosphere than the automatic. But this is not all. This increase in cylinder capacity means an increase of 30 per cent. of internal radiating surface, to say nothing of a like increase of external surface. It also means an increased loss in friction, in clearance, and in back-pressure above atmosphere, and frequently results in wire-drawing to such an extent that expansion cannot be profitably employed from ¼ cut-off, since the terminal pressure would be so low that the steam would be cooling the cylinder after it had ceased to do useful work. The results do not obtain with the automatic cut-off because the capacity of cylinder has not been increased, and because the steam has been expanded from boiler pressure. To make this plain let us borrow an illustration from the writer referred to, only assuming to dress it a little plainer for the more humble occasion. Take two cylinders of indefinite length and of such diameters that their areas shall equal 100 in. and 400 in. respectively. Let these cylinders be open at the top, and fitted with pistons, the weights of which are exactly balanced, and load each piston with a weight of 6,000 lbs. If now steam from the same boiler is admitted under each piston until the weight shall have been raised one foot, there will be under the small piston 60 lbs.+ the atmosphere= 75 lbs. per sq. in., and under the large one 15+the atmosphere = 30 lbs per sq. in. Assuming perfect conditions, and refinements in calculations, which would not materially change the comparison, there has been so far the same useful work done in each cylinder, but the large one has used 60 per cent. more steam than the small one.

If no more steam is admitted we may see how much more work may be done in each cylinder on expansion. If the weight is gradually removed from the small piston it will stop at five feet from the bottom, all the weight having been removed, and the pressure underneath being just equal to the pressure of the atmosphere on its upper surface. There has been done in this cylinder 12,000 foot pounds of useful work, 6,000 foot pounds of which have been done on expansion. If, in like manner, the weight is removed from the large piston it will stop at two feet from the bottom, and there will have been done in the large cylinder 8,312 foot pounds of useful work, 2,312 having been done on expansion. All the work possible under the conditions has been done in each cylinder, and while 48 per cent. more work has been done in the small cylinder than in the large one, 60 per cent. more steam has been used in the large one than in the small one. In the one instance the steam has been expanded from full boiler pressure, while in the other it has been wire-drawn to suit the load. This illustration is simply an exaggeration of the practical operation of the two mechanical systems of expansion. An investigation will satisfy the most skeptical that for all the ordinary uses to which the stationary or portable engine is put, the employment of the automatic system permits the use of a much smaller cylinder for the same work, thereby reducing the inevitable loss from condensation, back-pressure, clearance, and friction to the minimum.

It is designed to deal with extremes of temperature—admitting steam at the highest practicable temperature, or pressure, and releasing it at the lowest. Since the little useful effect we get in the cylinder of the steam engine results from, and is in proportion to these extremes of temperature, it needs no demonstration that in this respect it is a move in the right direction.

There are many combustible dusts, which are very dangerous. Zinc dust is imported in considerable quantities for use in certain branches of industry. It is a gray powder, and extremely fine. Great care should be taken to keep moisture away from it, for when moisture comes in contact with it it will readily oxidize—a process which is attended by a great rise in temperature—and the hydrogen gas which is liberated may take fire. This has often been the true cause of apparently mysterious ship and factory fires. Dry coal dust in mines will readily explode when ignited. These sources of disaster are not properly guarded against in America. It would be difficult to free mills and factories from the dusts that are constantly generated inside them. But they might be ventilated by strong air currents to carry off all the dust. Keep workmen from lighting their pipes and keep lamps and gas-lights out of the building. A match, a lantern, sparks produced by friction, any source of fire may produce a disastrous explosion.

Of Bessemer steel, the annual product in 1878 was 1,874,278 tons, worth at the place of manufacture something like a hundred million dollars. Of these establishments there are as yet more in Great Britain than in any other country. The next greatest number is in the United States, after which come, in the order of the extent of their product, Belgium, Germany, France, and Sweden.

It is stated that arrangements are in progress, and will shortly be completed, for lighting the entire Capitol at Washington with electric lamps of late invention. The apparatus is now being put in the building, and it is contemplated to place upon the summit of the dome very strong lights, with a view of experimenting in regard to lighting extended areas of a city from elevated points.

An English journal frankly gives credit to American genius for at least fifteen inventions and discoveries which, it says, have been adopted all over the world. These triumphs of American genius are thus enumerated: First, the cotton gin; second, the planing machine; third, the grass mower and grain reaper; fourth, the rotary printing press; fifth, navigation by steam; sixth, hot air or caloric engine; seventh, the sewing machine; eighth, the india rubber industry; ninth, the machine for manufacture of horse shoes; tenth, the sand blast for carving; eleventh, the gauge-lathe; twelfth, the grain elevator; thirteenth, artificial ice manufacture on a large scale; fourteenth, the electro-magnet and its practical application; fifteenth, the composing machine for printers.

Trials of the Hancock Inspirator.

An elaborate series of trials of the Hancock Inspirator was made by PARK BENJAMIN'S SCIENTIFIC EXPERT OFFICE, to obtain data for Appleton's Cyclopœdia of Applied Mechanics (see pages 170 to 173 of No. XIV,) at the factory of the company, in Boston, in May last. The experiments were conducted by Richard H. Buel, C. E.; and the report is as follows:

REPORT.

The Hancock Inspirator differs in some important respects from the instruments commonly classed under the head of injectors. It consists essentially of a lifting-jet and lifting-nozzle, combined with a forcing-jet and force-nozzle or injector, steam being admitted to both of these nozzles whenever the inspirator is in operation, to deliver the supply-water to the force-nozzle, and to force it through this nozzle into the boiler. Although both the lifting and force-nozzles are fixed, their proportion one to the other is such that the inspirator requires no adjustment for changes in steam-pressure or water-supply, the waste-valve being kept closed while the instrument is in operation, except at the time of starting. The sectional view of the stationary inspirator, Fig. 2428, will serve to explain the action of the instrument. In this figure, *A* is the steam-supply pipe, connected to the steam-space of the boiler; *B* is the water-supply pipe; and *C* is the feed-pipe, to which is connected an overflow or waste-pipe with waste-valve, these latter connections not being shown in the figure. *D* is the lifting-jet, *E* the lifting-nozzle, *G* the forcing jet, and *H* the force-nozzle. This latter nozzle is somewhat analogous to the combining-tube of an ordinary injector. *F* and *I* are stop-valves, the first controlling the admission of steam to the forcing-jet, and the latter determining the course of the water delivered by the lifting-jet. The action of the inspirator can perhaps be most simply explained in connection with a description of the manipulation required to start the instrument. In the figure, the inspirator is represented in operation; but when it is not working, a steam-valve in the pipe *A*, not shown, is closed, as is also the valve *F*, while the valve *I* and the waste-valve are open. Opening the valve in the steam-supply pipe *A*, steam is admitted to the lifting-jet *D*, drawing water through the supply-pipe *B*, and discharging it through the lifting-nozzle *E*, valve *I*, waste-valve, and overflow-pipe. As soon as water issues from the overflow-pipe, the valve *I* is to be closed, when the supply-water will pass through the force-nozzle *H*, and will escape at the overflow. The valve *F* is then to be opened, by moving the lever *K* one quarter turn, and the waste-valve is to be closed, when the water lifted and delivered to the force-nozzle *H* will be forced into the boiler by the steam issuing from the forcing-jet *G*. If the water-supply is to be varied, this can be effected by partially closing a valve in the supply pipe *B* without throttling the admission of steam; or both the steam and water may be throttled if desired. In practice, however, the delivery is varied by throttling the water-supply. Whatever changes of adjustment are made, whether of steam or water-supply valves, within the capacity of the inspirator, the instrument will continue in operation with the waste-valve closed. In this respect the inspirator differs materially from fixed-nozzle injectors, which cannot be operated with the waste closed, under the conditions recited above.

The principle of the locomotive inspirator, Figs. 2429 and 2430, is the same as that of the stationary inspirator just described, but the arrangement is such that all the operations of starting and stopping can be performed by the movement of a single lever; and the instrument is self-contained, being ready for attachment without the use of additional valves. A slight movement of the starting-lever admits steam to the lifting-jet. When water issues from the overflow, a further movement of the starting-lever closes one of the valves, thus turning the supply-water through the force-nozzle, admits steam to the forcing-jet, and closes the waste-valve, thus starting the instrument. In attaching this instrument to a locomotive, it is usual to place a "lazy-cock" in the supply-pipe, by means of which the engine-runner can control the water-supply without changing the position of the starting-lever.

In the tests made with the inspirator, both forms, as described above, were tried, the size of the instruments being No. 30, this indicating that the smallest diameter of the force-nozzle was 0.30 of an inch. This dimension was carefully checked by measurement. *But one inspirator of each form, locomotive and stationary, was used in the experiments, and no changes of any kind were made in them during the trials.* Some of the results of the trials are contained in Tables VII. and VIII., and the manner of obtaining the quantities in the several columns will be briefly detailed.

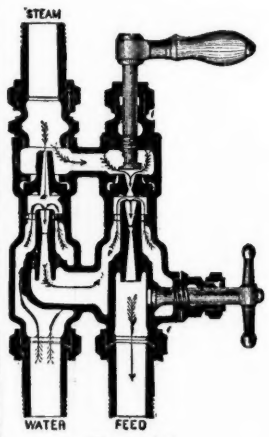


FIG. 2428.

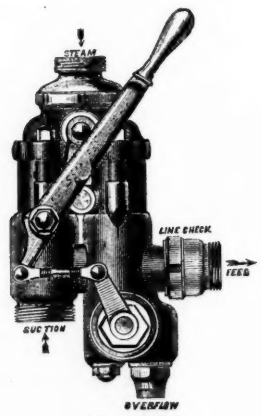


FIG. 2429.

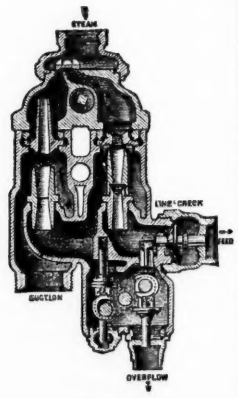


FIG. 2430.

TABLE VII.—*Maximum and Minimum Delivery of the Hancock Stationary Inspirator, No. 30, lifting Water from 2 to 8 feet; Temperature of delivered Water; Vacuum in Supply-Pipe; and relative Steam and Water-Pressures under which Inspirator will deliver Water. Temperature of Supply-Water, 70° F.*

Pressure of Steam supplied to Inspirator, and Pressure against which Inspirator delivers water Lbs. per Square Inch.	DELIVERY IN CUBIC FEET PER HOUR. Maximum.	DELIVERY IN CUBIC FEET PER HOUR. Minimum, Steam-Valve wide open and Supply throttled.	Ratio of Maximum to Maximum Delivery.	TEMPERATURE OF DELIVERED WATER, FAHRENHEIT DEGREES. AT MAXIMUM DELIVERY. At Maximum Delivery.	TEMPERATURE OF DELIVERED WATER, FAHRENHEIT DEGREES. AT MINIMUM DELIVERY. Steam-Valve wide open, and Supply throttled.	Steam throttled and Supply Valve wide open.	Vacuum in Supply Pipe. Inches of Mercury.	Lowest Steam Pressure with which Inspirator will deliver Water against Pressure in Column 1, Lbs. per Sq. In.
1	2	3	4	5	6	7	8	9
15	100.1	60.5	0.604	103	...	...	4	11
20	104.6	60.8	0.581	110	...	...	14	14
40	112.2	53.1	0.473	126	164	...	24	...
60	117.9	59.3	0.503	140	192	...	25	32
80	127.1	61.1	0.481	153	188	134	25	45
100	134.4	65.5	0.480	164	213	148	25	62
120	140.1	70.9	0.506	177	227	156	24	68
140	147.2	78.1	0.531	176	194	162	23¼	85
150	144.5	....	....	191	230	168	23¾	90

The steam and water-pressure were measured by gauges made by the Crosby Steam Gage and Valve Company of Boston. These gauges were tested by their manufacturers immediately before the trial, and were certified to be correct. The temperature of delivered water was measured by a thermometer inserted in the delivery-pipe, close to the inspirator. All the thermometers used in the tests were made by Huddleston of Boston, and were carefully tested. In determining the temperatures at maximum and minimum delivery, the water was forced into the boiler furnishing steam to the inspirator, and the results in Table VIII. and in column 9, Table VII., were determined under the same conditions. The boiler used in the experiments was of the sectional variety, and quite small, the grate-surface being only 6.25 feet. Considerable difficulty was experienced in maintaining the steam-pressure steady when forcing water into it by the inspirator that was being tested, so that, in the capacity experiments, the results of which will be found in columns 2 and 3, Table VII., the delivered water was run to waste, being throttled in the delivery-pipe until the water-pressure was equal to that of the steam supplied to the inspirator. The use of so small a boiler, apart from its inconvenience, was decidedly unfavorable to the performance of the inspirator, as considerable water was entrained with the steam, owing to the severe drain upon the boiler. To determine the quantity of water delivered by the inspirator, the supply-water was drawn from a tank which was supported upon platform scales, and the time required to deliver a given weight was measured by a stop-watch, the experiments being repeated several times, at each pressure, in order to check the results. The vacuum in the supply pipe was measured by attaching a vacuum-gauge to a short supply-pipe immersed in water, and nearly closing the water-supply valve. The highest admissible temperature of supply-water was measured by a thermometer placed in the supply-pipe, close to the inspirator, the supply-water being lifted from a barrel, and its temperature being regulated by mixing hot and cold water in the supply-pipe. The accuracy of this method of trial was also checked by gradually heating the water in the barrel until a point was reached at which the inspirator would no longer work.

TABLE VIII.

Highest Temperature admissible for Supply-Water, lifted 2 Feet, by the Hancock Stationary Inspirator, No. 30.

Pressure of Steam supplied to Inspirator and pressure against which Inspirator delivers water. Lbs. per Sq. In.	Highest Temperature of Supply-Water admissible in Fahrenheit degrees.	Temperature of delivered Water, when Supply-Water is at the highest admissible Temperature. Fahrenreit degrees.
1	2	3
15	130	170
20	134	175
30	142	174
40	142	212
50	143	222
60	143	236
80	143	240
90	142	250
100	142	246
110	142	264
120	142	262
130	142	276
140	143	272
150	144	280

In some further trials of this inspirator, on June 11 and 12, 1879, lifting-jets and nozzles of different proportions were used, with the following results: At a steam pressure of 50 lbs. per square inch the maximum temperature of supply water admissible was 151°; at 60 lbs., 146°; 80 lbs., 147°; 90 lbs., 145°; 100 lbs., 143°; 110 lbs., 144°; 120 lbs., 146°. Experiments were also made at different rates of delivery, and it was found that the maximum temperature admissible for the supply-water was practically the same whether the inspirator was working with a minimum or maximum delivery.

In addition to the experiments already described, the results of which are contained in Tables VII. and VIII., other trials were made, which are detailed below.

Delivering water against a pressure equal to that of the steam, the temperature of supply-water being 69°, and the lift 2 feet, the lowest pressure at which the inspirator would start was 12 lbs. per square inch with a free supply, and 9 lbs. with the supply throttled. Once started, and delivering under a free discharge, the inspirator continued to work as long as there was any indication of pressure on steam gauge. Delivering against a water-pressure of 5 lbs. per square inch, the inspirator continued to work until the steam-pressure was reduced to 1 lb.

Experiments were also made to determine the time in which the inspirator could be started, when both the instrument and the supply-pipe were heated by allowing steam to flow through for a short time. With the stationary inspirator, lifting water from 2 to 3 feet, allowing steam to flow through, and then starting the instrument at once, without closing the steam-valve, the time required to start was 16½ seconds when the temperature of the supply-water was 116°, and 6½ seconds when the temperature of the supply-water was 76°, the steam-pressure being 95 lbs. per square inch, and the water-pressure the same.

Using the locomotive inspirator, with a lift of 3½ feet, steam-pressure of 125 lbs. per square inch, water-pressure 160 lbs., and supply-water 70°, the time required to start, after heating the instrument and supply-pipe as hot as the steam could make them, was 2 seconds. With a lift varying between 2 and 3 feet, and a steam and water-pressure of 95 lbs. per square inch, it was found that the inspirator would start promptly (not a single failure occurring) with supply-water heated to the highest temperature admissible for regular working. At these moderate lifts it was found that the water could be taken by the lifter, and discharged at the waste orifice, at much higher temperatures than were admissible for the operation of the inspirator—the temperature of the supply-water being raised to 195° without sensibly affecting the prompt action of the lifter.

A number of trials were made to determine the amount of water wasted in starting the locomotive inspirator, and the average was 1.15 U. S. quart.

The stationary inspirator was fitted up with a supply-pipe having considerable flexibility by reason of two right-angled bends, and attempts were made to stop the operation of the instrument by striking and jarring the supply-pipe, the steam and water-pressure being 130 lbs. per square inch, and the lift 3 feet. After extraordinary exertions, the jet was broken in a single instance, and the inspirator stopped, but only by straining the connections to such an extent that it was considered unsafe to repeat the experiment. The supply-pipe was jarred by heavy blows applied at various points, without affecting the operation of the inspirator.

The results of the experiments in Table VII. show that the inspirator requires no adjustment for changes in steam-pressure and water-supply; and a further experiment was made by simultaneously reducing the steam and water-pressure from 150 to 2½ lbs. per square inch, keeping the waste-valve closed, without adjusting either the steam or water-supply. This experiment affords additional proof in regard to the adaptability of the instrument to varying conditions of pressure.

After completing the experiments already described, the stationary inspirator was connected 25 ft. above a tank, and was started with a steam-pressure of 50 lbs. per square

inch, delivering against an equal water-pressure. The water-pressure was then increased to 80 lbs. per square inch before the inspirator ceased to work. The temperature of the delivered water in this experiment was 156°. Again starting the inspirator at 25 feet lift, the steam and water-pressure of 50 lbs. per square inch, these pressures were gradually reduced, and the inspirator continued to operate as long as there was any indication of pressure in the steam-gauge, the water-pressure being 2½ lbs. per square inch.

The inspirator is sometimes used to elevate water into tanks, using the lifting jet only. With a lift of 25¼ ft., the temperature of the delivered water was only increased from 70° to 83°.

Experiments were also made upon the ease of starting the inspirator at a lift of 25 ft. With the inspirator and supply pipe at ordinary temperature, the time required to lift the water was 10½ seconds; and to start the instrument, the steam and water pressure being 50 lbs. per square inch, the time required was 21½ seconds. The inspirator and supply pipe were then heated by blowing through, and water was lifted in 48½ seconds. These trials, together with those made at low lifts, previously detailed, show the remarkable promptness of the instrument in starting, under all conditions within its capacity.

The lifting-jet used in these experiments was proportioned for a steam pressure of 60 lbs. per square inch; and to show the range of this jet, after the inspirator had been started on a 25-ft. lift, the steam and water-pressure were simultaneously increased to 80 lbs. per square inch before the jet broke. Reducing the lift to 24 ft., the steam pressure required to start against an equal water pressure was 45 lbs. per square inch, and the range was considerably increased, the steam and the water pressure being varied to 100 lbs. per square inch before the jet broke. With a lift of 24 ft., and steam and water pressure of 50 lbs. per square inch, the water in the supply pipe was heated to 117° before the inspirator ceased to work.

On June 11, 1879, some experiments were made with a stationary inspirator, No. 20, at higher lifts than had been previously employed. The lifting-jet used was proportioned for a steam pressure of about 60 lbs. per square inch, at a maximum lift; and the results of the trials are appended. For a lift of 26 ft. 7 in. the steam pressure required to start the inspirator was 60 lbs. per square inch, and the time employed in starting was: From time of opening steam valve to lifting water, 10 seconds; and from time of opening steam-valve until inspirator was in operation with a water-pressure equal to that of the steam, 38 seconds. After the inspirator was started the water-pressure was increased to 95 lbs. per square inch, the steam-pressure being 60 lbs. before the jet broke. The lift was then increased to 27 ft., and the inspirator lifted water in 11 seconds with 63 lbs. of steam, and delivered water against a pressure equal to that of the steam in 52¾ seconds. The water-pressure was then increased to 95 lbs. per square inch before the jet broke; and to show the range of this particular lifting-jet, the steam and water-pressure were simultaneously reduced to 10 lbs. per square inch, and then increased to 70 lbs. before the inspirator ceased to operate.

In the manufacture of a gun barrel the process has changed somewhat at the Springfield Armory since 1861. Then an iron "scalp," 18 inches long, 6 inches wide, ½ an inch thick, and weighing 10 pounds, was thrown into a furnace, heated, and curved in a rolling machine. It received only two welding heats, but was changed many times from the furnace to the rolling machine, or until it was rolled to the proper size and extended to the length of the barrel. In the rolling process a cavity was preserved with different sized steel rods. While hot, the barrel was passed on a rod into a straightening machine, afterwards annealed, coneseated, bored, turned, ground, milled, rifled, and polished. Now the workmen start with a steel bar eight or ten feet long and about one inch in thickness; cut it into pieces six or eight inches long, bore each piece, pass them into a furnace on a rod, then into the rolling-machine, and proceed as in the old process.—*Holyoke Manufacturer.*

Scraped Surfaces.

BY CHORDAL.

Scraping is so common a thing in most shops that nine out of ten machinists will hardly believe that the tenth man don't know anything about scraping, and still is a machinist. It is true, however, that many machinists work for years and never come into contact with what we know as scraped work. They don't know why it's done, or how it's done, and they don't care. Still, they are machinists, and good ones often, though they may never have handled a scraper, and don't know anything about lead lapping, or case hardening, or hand-reaming, etc., and so on. They fulfill their mission upon earth in their own way. These boys would do well, however, to post up on the subject, and may then be able to fulfill their mission in a manner a little more satisfactory to themselves and their patrons. There is one villainous practice followed in some shops which goes by the name of scraping: For instance, a man has an odd pulley to turn, he finds it as hard as blazes, and has to re-set his tool two or three times, even on the finishing cut. This leaves a bad looking job, and he takes a square-ended scraper and gouges at it awhile, and finally takes it from the lathe—a worse looking job than our grandfathers used to do when they depended on hand tools altogether.

Look up at the line shaft and see such a pulley. It is six inches face, but is scraped full of hollows, so the belt bears on a lot of rings which are not equal to a four-inch face pulley.

There is a better way of getting around a hard pulley job, and though it bears no relation to scraped work it will be well to mention it here. It is known as the coarse feed plan, a plan, by the way, which is never adopted in shops that don't know anything about scraping. Get the pulley roughed off—clean and in good shape as possible. Then, instead of trying to worry a pointed tool across it to finish with, put in a broad, slightly rounded, square-nosed tool, the same as you would use for a water cut on wrought iron, only broader. Set the feed at four to the inch, run slow, and this tool will get through its work before it has time to think about getting dull. The tool should be a spring neck tool to prevent gouging.

Besides pulley work, these scientific "scrapers" use the same tool on any kind of face work they want to get a polish on. It's a fraud and won't compare with work done with the proper lathe tools, of which more hereafter. This tenth man sometimes sees a new planer, or something which has scraped surfaces upon it, and he thinks it is awful nice, but is under the inpression that it is all done for looks. Not a bit of it; see here: Suppose you are building a planer; you plain up the cross rail as nice as you know how, and you do the same with the saddle. The angles are all right and you know they will fit; but when you come to put the work together you find the saddle rocks. It stands on legs and don't bear all over as it should do. You give it a rub and find a shiny spot on the rail where it is high. That shows at once that your shop planer is liable to make crooked work. It don't make any difference why it did it, whether because it was crooked itself or because there was a hard spot in the iron, or because one of the trip-hammers out in the blacksmith shop shook the planer, or what not, you see it did do it, and more than that, it will always do it.

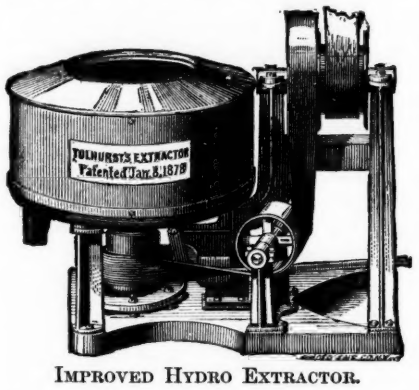
No matter how nice your planer is or how nice your iron is it will always do work which is not flat. They all do it.

Now, about this new planer you are building: If you let it go that way, it won't be true at all, and it won't wear any truer because the high spot, while it is wearing down, will wear a groove in the saddle. More than that, if there is one spot, there is probably a dozen, and, as the wear is all concentrated on these little lumps instead of the whole broad surface, as it should be, your planer will soon wear out. Now suppose you do as the heathen do, and use oil and emery, and grind the saddle to the rail. Do you straighten it? Not at all. You grind off some high places, it is true, but your grinding is operating at points where there are no spots; so you really make the job crookeder than it was before.

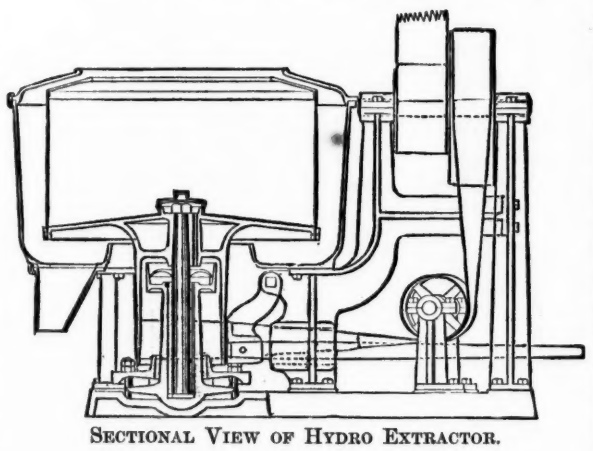
You get a uniform color on the job and it really bears all over, but that is all you can say. Besides that, you have bedded the emery into the iron and never can get it out, and the thing will grind forever, that is till it wears out, which will be very soon. Another thing; when a job wears into bad shape you say it "cuts." What is "cutting?" It is simply deep scratching in wearing surfaces, and always in the direction of the wearing motion. When a surface gets cut a little it will soon get worse for the oil will not distribute itself over the surfaces nicely, being confined and guided too much by the groove formed by cutting. A planer produces a surface formed of fine grooves running in the direction of the wearing motion. In the case of our planer rail, so would grinding, and so would drawfiling. In short, by either plan, the "cutting" process of wear would be given a good start before the machine is even finished.

In fact, we have a job half done, it is not straight and true, and the tool marks run in such a direction as to prevent the distribution of oil, while we want a true job which will have good surface contacts so as to wear well; and we want any scratches there may be to run in such directions as to aid the distribution of oil instead of preventing it. Scraping is the thing we want. This article don't go into the *modus operandi* of scraping, but is simply intended to point out the importance of the operation. A scraper is simply a tool for reducing high parts, and at the same time removing the tool marks and substituting little oil-distributing channels running in every conceivable direction.

Scraped surfaces of proper size and properly lubricated will never wear out and they will slide like glass on velvet. Scraping is not for looks, but it looks good after all when you know that it *is* good.



Improved Hydro Extractor.



Sectional View of Hydro Extractor.

Improved Hydro-Extractor.

The machine illustrated herewith is known as Tolhurst's Hydro-Extractor, and is of value to mills making cotton, linen and woolen fabrics, as well as to laundries and dying works. It is manufactured by the inventor, W. H. Tolhurst, Troy, N. Y.

The mechanism of the machine is very simple, the galvanized iron tub or shell shown in the cut having an inner tub or receiver, which is perforated at the sides to admit of the copious discharge of water which takes place in the operation of drying fabrics, as a consequence of the great rapidity with which the inner receiver whirls when power is applied.

The sectional view accompanying shows the method of applying power and the internal mechanism of the machine so clearly, as to be easily understood by the practical machinist, requiring no extended description at our hands.

The articles to be dried are placed in a wet state in the inner receiver; the application of power sets this portion of the machine whirling at a rapid rate of speed, and the moisture contained in the articles to be dried pours outward through the holes in the side and downward through the spout at the bottom in a stream usually as thick as a man's arm. The writer has personally seen what was stated to be 4000 linen collars at one time undergoing the drying process in an ordinary sized machine, the work being thoroughly accomplished in a surprisingly short space of time.

The machine is self centered, requires no heavy foundation, and can be run on any floor of any building. It is claimed that it does not spot the goods, wringing them so dry that the saving of steam and time alone in the drying-room of a mill will repay the cost of a machine within the first year. The machine is made in four sizes, designated as 20, 24, 30 and 36 inch respectively.

This class of machinery, from the growth of American fabric manufactures, and especially from the rapid development of the laundry interest as a substantial business, offers many attractive features to the practical machinist, and Mr. Tolhurst has achieved success in it as the result of study and experiment, combined with experience.

Notwithstanding his undoubted services to the laundry machinery interest, however, there is one direction in which all our inventors in that department have fallen short of the public need, and that is a machine warranted to prevent laundrymen from sending to one lady's husband the clothes that properly belong to some other gentleman's wife, thus avoiding, in many instances, a very unpleasant shock to persons of delicate sensibilities. We commend this suggestion to philanthropic and practical machinists everywhere.

The hand cars for passengers in the Paris sewers are neatly made and furnished with cane seats. The line rolls directly over the sewers. The air is described as "averaging a good strong smell." Male excursionists smoke, and feminine snuff perfumed handkerchiefs. No one has yet been known to want to make a tour of the sewers of New York.

The English Parliamentary Committee's report on electric lighting says, that sufficient progress has been made to encourage the belief that electricity has a future for illuminating and as a source of mechanical power.

George Westinghouse, inventor of the air brake, has proposed a new method of lighting railroad cars. His air brake places a supply of compressed air at disposal; a current of this is passed through carburetters placed under the cars so as to produce an air gas, which is used for lighting the passenger cars.

The contractors are now at work putting the steam heating pipe into the new government building, at Chicago. Some idea may be had of the magnitude of the work when it is known that the contract provides for over forty miles of pipe, which will extend through every department of the building.

The Steam Engine.

BY STEPHEN ROPER, ENGINEER.

There are few more interesting subjects for investigation than the steam engine, in its application to the various arts of human industry. When we consider our dependence on machinery for the production of the myriad articles of use and ornament, which have come to be regarded as necessities in our daily lives, we can hardly perceive how our progenitors could so long have endured existence without its aid. Machinery could never have made such advances, nor could the comforts and necessities of life have been so multiplied but by the assistance of the steam engine, "man's universal servant, and willing drudge." The debt which we owe to this wonderful embodiment of almost human intellect and brute force, can be comprehended only in part. It assists in building our houses, clothing our bodies, preparing our food, furnishing us with unnumbered luxuries; besides, it subdues even the elements to our will. Before its power the rugged mountains lower their heads, and the seas contract their shores. But while its effects on civilization can scarcely yet be estimated, we cannot but observe that its most important results have been achieved through the medium of transportation. The facilities extended to travel, by bringing mankind into closer contact, and sharpening the intellect by the potent process of attraction, has reacted favorably upon every other department of human knowledge and industry.

There is something awe-inspiring in the fact of a production of human skill, a mere machine endowed with power and endurance, surpassing a thousand times the puny strength which forged its parts, dragging after it, with lightning speed, hundreds of human beings and tons of merchandise, from ocean to ocean, across vast continents. How bewildered grows the imagination as we attempt to follow it in its course; laboring over mountains, and traversing trackless plains, for thousands of miles; ever toiling, with ceaseless perseverance, until the goal is reached? It is impossible to divest this wonderful "thing of life" of a poetic grandeur, suggested by its vast results in which the dreams of classic antiquity have been more than realized. What would the wise savans of the last century, who predicted so vehemently the failure of steam as a motive power, think, were they suddenly brought to life, their mental faculties resuming their functions just where they left off a hundred years ago? Truth has in this instance again proved itself "stranger than fiction," and the visionary schemes of the enthusiastic specialists have been far eclipsed by the sober and familiar facts of to-day, notwithstanding the indignant contempt which their predictions once brought forth.

From the important and increasing influence of the steam engine on human affairs, controversies have frequently arisen between writers of different nations respecting the claims of their countrymen to its invention. But the steam engine cannot be said to be the invention of any one man, or belong to any one nationality. Where or by whom the idea that the expansive force of steam could be employed as a motive power was first conceived will, probably, never be known, as descriptive literature is very incomplete in the information it has gathered into its pages on this subject. It may be said to be a development, each detail of which is an especial result from the labor and intelligence of individual mechanics; as the old and new records show that as a machine, the steam engine was never at any period covered by any valid patent.

It is strange that it wearies a man's legs so much less to stand in front of a bar than it does to stand by a work-bench.

It is computed that the saving in gas alone, during one winter, in a New England gingham mill, constructed on the one-story principle, as compared with buildings of two or three stories, paid the interest on the cost of the building.

Engine Proportion and Construction—Steam and Exhaust Valves.

Editor American Machinist:

I do not think I will here attempt to enumerate the various kinds of valves, induction and eduction, that have been used with positive and detachable motions during a quarter of a century; for in the first place I have no intention of monopolizing the whole of your valued journal, and in the second place I have not the time to devote to such a laborious task.

The single-seated puppet valve was used for many years in the old countries, but always under low pressure. This valve has been used in this country for a long period, especially on the Western and Southern River boat engines, and in these cases under very high pressures. Many ingenious methods for relieving the enormous pressure at the beginning of *lift*, or opening, have been used, one of which certainly deserves notice. This device consisted in the attaching of a small puppet-valve on, or very close to, main valve, opening into port or passage. A small toe or rock-shaft *first* came in contact with the auxiliary valve stem, a *little* in advance of main toe. Of course, the instant the small valve was raised, the pressure on large valve was rendered neutral, and it was picked up with perfect ease, these valves closed either by gravity or springs. The *double* puppet-valve was also used abroad in the early days of the steam engine, but its present form and manner of application and operation was left to our American Engineers to perfect; they have modified this valve to such an extent that it is classed with the balanced valves; it can be made so near a balance that it leaves nothing to be desired in that direction.

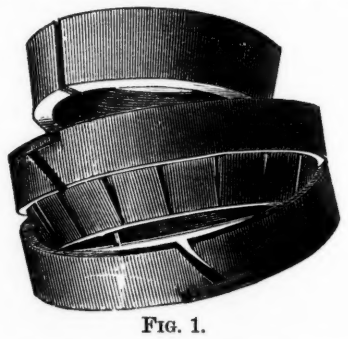


FIG. 1.

The only trouble with a double puppet-valve outside of its cost in making is the matter of expansion. They *must* be ground to their seats when *hot*, and at the same temperature that they work in, or they *will* leak. I saw them used a number of years ago, in a way that helped this trouble considerably but not entirely. In this case the valve was brass, and was fitted into a brass cylinder that answered for the seats; there was a similarity of form to valve and seat; the seat or cylinder was forced into a cast-iron chest, but was not fastened by screws; the cylinder had openings all around it for the free passage of the steam. Unless the steam was super-heated to a degree that left little condensation at the chest, these valves were considered tight. Except the single port-flat slide, the D slide-valve is next on the list. It is used mostly for locomotives, and for stationary engines only, where fuel is of little or no account. The D valve is in its *best* form when double-ported and partially balanced by its particular shape, the travel is then reduced about one half. I have yet to learn why it is not used more extensively by the locomotive builders. It is coming into general use on marine engines, and it certainly gets hard usage there, and no favors.

Then for effecting cut-off, there are the double slide-valve, one fitted to, and traveling on the back of the other, with independent eccentric, some of them balanced, others working under full pressure. This style of valve is arranged in a most ingenious and substantial manner, on the well-known quick speed Buckeye Engines.

But the valve that I desired to speak of at length are those generally used in connection with disengaging valve motion. Of this class the Corliss is, with the exception of the puppets and common flat types, the oldest. The Corliss or segmental valve wears very well for two or three years, and at the end of that time must be replaced, *seats re-bored*, otherwise they will leak to a perceptible degree. A bad feature of this style is their being *single* ported, they require a long travel, which is very troublesome in anything like quick motion. The Corliss Engine is rarely speeded over 70 revolutions, even the small sizes. A long traverse of a drop valve is also bad for steady regulating. The segmental valve cannot be called a bad one, but it is surely not one of the best. We all have our opinions on mechanical matters, which, of course, we are honestly entitled to, and I believe most of us have what may be termed a weakness for expressing our opinions, whether called on to do so or not. I will therefore beg pardon here for my opinion, that the best valve in use to-day on a detaching or automatic engine is what is known as the *sliding gridiron* valve with a number of *narrow* ports. The credit for the introduction and general application of this valve, both as a steam and exhaust valve together with their chests, is due to Mr. William Wright, the well-known engine builder of Newburgh, N. Y. The writer made working

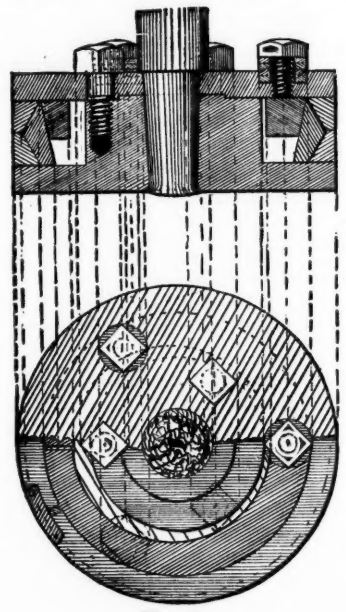


FIG. 2.

drawings under this gentleman's supervision for valves of this kind twenty-five years ago. Some of these valves were made perfectly flat, others in the form of a V; the latter were fitted into the chest of old puppet-valve engines, the old valves, of course, being removed. They gave general satisfaction at that time, and have since been used with great success by the original inventor Mr. Wright. At the date I spoke of, above, this gentleman built engines of 75 to 100 horse power, the greatest lift of steam-valve being *one-fourth of an inch.* These engines ran at about 60 revolutions per minute, but, as far as the valves were concerned, could have run at 100 revolutions without trouble, but the detail of transmission was not designed for high speed.

The piston valve (balanced) is in use both here and in Europe, but to a limited extent, its main fault is the requiring of nicety of adjustment, and it also must have a long movement. They are mostly used for steam pumps and hammers. But there are no valves that do not require care and watching. We are using high pressure, and in some cases super-heated steam in these times. Compound engines with 100 lbs. initial pressure are not expected to derive much benefit in the way of lubrication from natural condensation, they must depend on the *grease*, and that article must be at prompt call, and the movement of *all* valves must be brought to the lowest possible point.

WM. H. HOFFMAN.

Passaic, New Jersey.

It is stated that the growth of the Trenton, N. J., crockery trade has reduced the importation of foreign ware from 35 to 40 per cent. during the past three years.

The Sahara Railway Commission held its first meeting in Paris on July 21st, and divided itself into four sub-commisssions, which will devote themselves to documentary data, technical studies, explorations, and international bearings.

Flexible Packing Rings.

The packing which we illustrate on this page is composed of four separate rings, as shown in Fig. 1, where the reader will observe that the two outside rings are intended to bear upon the surface of the cylinder, while the other wedge-shape rings are to be used for the purpose of expanding them. These rings are intended by their flexibility to easily adapt themselves to cylinders which are worn out of parallel, or are not round, and in most cases are said to obviate the necessity of re-boring the cylinder, and if placed in true cylinders they may never need re-boring. They are said to be easily adjusted and never necessary to take off the piston follower in order to set them out, as is necessary in some other designs of packing rings. In order to set out the rings, it is only necessary to remove a washer from each of the three set screws, which are inserted in the piston follower (and whose ends come in contact with the edge of the inside ring) and screw up to the next washer, therefore requiring no skill to perform this operation.

Referring to Fig. 2, the reader will observe the inside ring is so placed that when the three set-screws, previously mentioned, are tightened, they will press this ring towards the opposite side, thereby setting out the outside rings. The large intermediate ring, which is placed between the outside and inside rings, has slots placed at short intervals in order to make it flexible.

These piston rings are made by C. R. James & Co., Jersey City, N. J., and are used in many of the large engines in New York and vicinity.

The Song of Steam.

BY REV. J. W. CUTLER, COVINGTON, KY..

Harness me down with your iron bands,
Be sure of your curb and rein;
For I scorn the strength of your puny hands,
As a tempest scorns a chain.
How I laughed as I lay concealed from sight,
For many a countless hour,
At the childish boasts of human might,
And the pride of human power.

When I saw an army upon the land,
A navy upon the seas,
Creeping along, a snail-like band,
Or waiting a wayward breeze:
When I saw the peasant reel
With the toil that he faintly bore,
As he turned at the tardy wheel,
Or toiled at the weary oar.

When I measured the panting courser's speed,
The flight of the carrier dove,
As they bore a law, a king decreed,
Or the lines of impatient love—
I could but think how the world would feel,
As these were outstripped afar,
When I should be bound to the rushing keel,
Or chained to the flying car.

Ha! ha! ha! they found me at last,
They invited me forth at length;
And I rushed to my throne with a thunder blast,
And laughed in my iron strength.
Oh, then, ye saw a wondrous change
On the earth and ocean wide,
Where now my fiery armies range,
Nor wait for wind nor tide.

Hurrah! hurrah! the waters o'er,
The mountain's steep decline;
Time, space, have yielded to my power!
The world! the world is mine!
The rivers the sun hath earliest blest,
Or those where his beams decline,
The giant streams of the queenly West,
Or the Orient floods divine.

The ocean pales, where'er I sweep,
To hear my strength rejoice;
And monsters of the briny deep
Cower, trembling, at my voice.
I carry the wealth and ore of earth,
The thought of God-like mind;
The wind lags after my going forth,
The lightning is left behind.

In the darksome depths of the fathomless mine
My tireless arm doth play,
Where the rocks ne'er saw the sun's decline,
Or the dawn of the glorious day;
I bring earth's glittering jewels up
From the hidden caves below,
And I make the fountain's granite cup
With a crystal gush o'erflow.

I blow the bellows, I forge the steel
In all the shops of trade;
I hammer the ore, and turn the wheel,
Where my arms of strength are made;
I manage the furnace, the mill, the mint;
I carry, I spin, I weave;
And all my doings I put in print,
On every Saturday eve.

What Constitutes a Good Lathe.

BY L. F. LYNE, M. E.

As has been mentioned in a previous article, the turning lathe is the first and most important tool required in a machine shop, about which much has been written, inventors having been worrying their brains in trying to overcome the obstacles which have hitherto presented themselves in the shape of traditional forms of the different parts of the machine. The writer is pleased to say that these traditions and prejudices are gradually being overcome, and to-day the lathe is more fully understood, and is being correctly adapted to the different branches of work, in the large range which it is capable of covering. A good lathe should be capable of turning a true circle, of boring a perfectly round and parallel hole, to face off a true plane surface, and all this it should admit of doing in the shortest possible time. It is also expected that a screw-cutting lathe will produce a perfect thread, and not only is it necessary that it fulfill all the foregoing requirements a few times, but that it continues to do so year after year with the least possible adjustment and expenditure for repairs.

The writer has frequently heard it remarked in the shop that "any fool can work with tools," and in many cases the observance of this principle on the part of employers and foremen is productive of harm; for while the fool is said to be able to work with tools, and the employers not wishing to employ fools in their shop, the men are obliged to get along as best as they can without the tools that are actually needed. I believe in giving good men good tools, and requiring them to be kept in order. In this way a hurried job may be done in less time than it would take to get the tools ready under other circumstances.

The great aim of manufacturers now is to devise machines by which they may be able to utilize unskilled labor. The prejudices of the workmen themselves have been a great drawback to the introduction of improvements. For instance, a man who has always used a hand lathe with heel tools does not like to be set at work on any other. There is a great disposition now-a-days, on the part of the men, to exercise brains as little as possible, the extent of their ambition being to get through ten hours a day, and then leave the shop and its associations until the next day. This class of men never rise to positions of honor so long as they entertain these principles. The turning lathe is required at the present day to do a greater variety of work than ever before, hence the necessity of special lathes, some of which take their names from the particular class of work to which they are adapted.

In this article I have in mind a lathe designed to perform the greatest variety of work, such as is required in shops generally. I am decidedly in favor of a flat bed or shears for the following reasons: They are more firm and less liable to spring, and extended surface is necessary to durability. Some will argue that the large surface gives more friction. Friction is dependent upon weight not upon surface; therefore, with the same care given to a V shear the carriage will move on the flat top equally as easy, if not more easily. In England, most of the lathes are built with flat top shears, but in the United States it is just the contrary. Why it is so no one pretends to say; however, "facts are stubborn things, meet them as you will;" and this is a fact, viz., whenever a special lathe is required for heavy work and durability, a flat shear is always adopted as in the case of the best axle lathes. The carriage has a better bearing on the flat shear, hence it will stand a heavier cut, and will work smoothly, whereas, on a V shear, it has a bearing only at or near the ends. The carriage can also be made lighter on the flat shear, and the extended surface will better exclude the dirt than on the V shear. An important advantage in using a flat shear is that the reduction in the thickness of carriage will increase the capacity of the lathe by allowing it to swing larger pieces of work. Let it be understood that "molasses," or oil resembling it both in appearance and action, cannot be used on a flat top shear, or any other, without serious trouble.

An axle lathe with a V shear would not answer, because it would wear hollow where used the most; and why should not this test recommend the adoption of the flat top shear for other lathes? It is by far the easiest to fit up and to keep in order.

The inside edges of the shears should be planed tapering about one-eighth of an inch to the inch, so that the back head will fit into its place without lost motion, and when it does occur, can easily be taken up.

In some cases the manufacturers make a V on the under side of the shear, upon one side with a corresponding shape on the clamp by which the back head is held fast, so that when the bolts are tightened the head will always be drawn up to the same side of the shears, thereby always insuring the alignment of centers. Let it be borne in mind that there are numerous strains on the bed of a lathe when at work, all acting in different directions. The strains upon the centers have a tendency to bend it in the shape of a bow, while the revolving spindle produces a severe torsional strain upon it. The bed therefore should be strong enough to resist strains in all directions, and by the use of the flat top shear the cross braces can be extended nearer the top than is possible with the V shear. The leading screw, as it has been remarked before, should not only be independent of the feed, but should be properly supported so as to maintain as nearly as possible, a straight line, as it will be found to make a more perfect thread. There are lathes now built having the screw placed in a trough or cavity directly under the inside edge of the top of the shears. The advantages claimed for this arrangement, in addition to keeping the screw in line are, that it is kept free from dirt, and when cutting a thread the line of strain is brought as nearly in line with the tool post as possible, and near the center of carriage.

Where the screw is placed down near the bottom of the bed it is inclined to twist the carriage; and to any thoughtful mind this becomes apparent at once. The feed motion should be connected by gears from the spindle to a small shaft running the length of the bed, and by suitable devices to the pinion that works in the rack. The principle is to apply the feed power as near the tool post as possible, thereby avoiding unnecessary friction.

The spindle should be made of steel, with good large bearings, which must each be an exact circle, for they will reproduce their own shape. There must be no end motion, and the lathe must have a proper device for taking it up when it does occur through wear. I am in favor of the extension of the spindle, though the bearing to receive the different change gears for feed and screw cutting, in this plan, does away with the complication of gears under the cone, which are always a source of trouble and accumulation of dirt. The castings can then be made solid under the cone and kept clean. All lathes should have a projection on the casting to prevent the belt from running into the gears, for the writer has seen otherwise good lathes, on which the belt could only be kept out of the gears with the greatest care.

The cone pulleys should be properly proportioned to the back gears so that the speeds will increase and diminish in exact ratio to each other.

The cone should be turned inside and outside, thereby avoiding that thumping sound which exists in some lathes after they have become a little worn, which reminds one of a "country grist-mill." The cone should be wide enough to run a good wide belt, large in proportion to the size of the lathe, for there is nothing lost by a little excess in this particular. There are very few

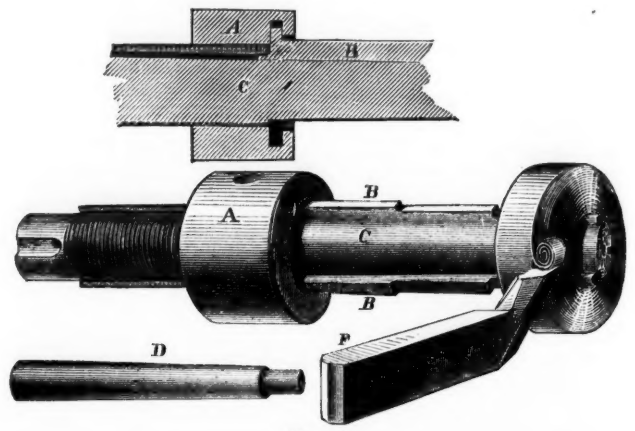


FIG. 1.

lathes in which the line center will run true except in one position, which shows that the proper discretion was not used in boring the hole for the center. The proper way is to finish the spindle on the outside, then bore and finish the hole for the center which insures a perfect job. For application of chuck, manner of applying gibs to slide rest, and application of centers, the reader is referred to my previous articles. In the latest improved back head there are eccentric rollers, so placed that when it becomes necessary to move the head, it may be raised clear of the shears, so that the entire bearing comes upon the rollers: thus it is easily moved, besides avoiding the accustomed wear upon the shears. In place of the ordinary screw for holding the spindle from moving, a split,

FIG. 2.

FIG. 3.

conical-shaped sleeve is used on the end next to face-plate, which is forced into place by a large nut which covers it, and insures a central position for the spindle every time.

I believe in having just enough motion sideways on the back head to allow the alignment of the centers to be rectified, which becomes necessary as the lathe wears, and never drawing the head over in order to turn tapering, for the following reason: viz., It is impossible to get a perfect bearing on the centers when they are not in line. There are good devices for turning tapering, which are applicable to any lathe at a nominal price, and will soon pay for themselves. This former or taper attachment gives greater capacity to the lathe than the other, as in the case of very short tapers and irregular forms. The cross-slide of the carriage and slide-rest should fully cover the slides so as to exclude all dirt. All parts should be easily accessible in case of accident or repairs. There are other points which I desire to mention, but will defer them until some future issue.

Improved Machinists' Tools.

While much time and talent have been employed in improving the machines generally used in iron working shops, very few have given special attention to improving and better adapting the small tools and attachments universally employed in machine shops. One of the few individuals who have made this branch a life study is C. W. Le Count, South Norwalk, Conn., who has justly achieved a wide and lasting reputation for his specialties, some of which we review, with cuts, in our present issue. Le Count's Expanding Mandrel, Fig. 1, is for holding wheels or other pieces to turn. It takes the place of a mandrel fitted and driven with a hammer, and its use effects a great saving of time. It is used in turning wheels, collars, boxes, or anything that has a hole in it. Its perfectly satisfactory use for fourteen years is sufficient evidence of its merit.

C is the steel mandrel; B B are two of the three keys that are drawn up and pushed down in a dovetailed groove, rising from the point, by the nut. A groove is turned inside the nut A, which catches the head of the key B, and thus draws them up to tighten the work. This, like any mandrel, requires a true hole to make a true job. Very heavy cuts, on large diameters, can be done on it without slipping. F represents the tool in operation.

Fig. 2 represents Le Count's new Steel Clamp, which is very strong and well made. The screw has a square thread with button on a ball, which will accommodate itself to irregularities without bending the screw. The foot of the clamp is planed. Fig. 3 shows Le Count's improved steel dog with hardened steel screws turned in the lathe. People may say "Every dog has its day," but this dog remains as much of a favorite as ever, and the "dog days" are not yet ended. Unlike dogs of the canine persuasion it never goes mad, and unlike some other lathe dogs it never causes its owner to get mad through any fault of its own.

Tramps always avoid it. A full-fledged tramp would sooner face a bull dog that means business than have anything to do with an active lathe dog.

Fig. 4 exhibits Le Count's new and improved boiler clamp, for use where other clamps are not strong enough, and in places where there is hammering and other rough work. It is made of steel and opens four inches from center of screws, and runs back four and a half inches.

Fig. 5 gives a view of Le Count's Vise Clamp, which is for holding pieces together for drilling or other purposes. It has steel screws hardened the whole length, a spring temper and ball head so as to clamp an object at any angle without bending the screws.

Fig. 6 presents Le Count's Machinists' clamp of malleable iron, with hollow back and steel screws, hardened. It is a light handy tool.

The American locomotive exhibited at the Paris Exhibition was recently sent to Milan for trial, having been refused at Florence. Great opposition has been made to it by the Belgian and English makers of locomotives, but in spite of foreign jealousy, it is probable that a trial will be accorded, and it is thought the prospects are bright for the introduction of American locomotives on Italian railroads.

FIG. 4.

Methods for Keeping Workmen's Time.

Mr. Editor:

It strikes me rather forcibly that Silex has got the bull by the wrong horn. As I understand Chordal, he wants a system that will run itself—something automatic, as it were—he not having looked into the thing deep enough, has called upon the readers at large for points, and it is to be hoped for the good of said readers he will get just what he wants; and right here, I want to say, I hope Silex will not be backward in bringing forward anything good he might have to say, and I think I will be justified in saying that whatever he might have to say will have its due share of consideration.

If, as he says, Chordal has gone back to the time when systems of any kind counted but little on either side of the ledger, suppose we go back with him and see how the thing was done. Perhaps we will find something that, for simplicity, cannot very well be equaled at the present day. I mean simply asking the man how much time he worked and counting out the money. In that case we could always be sure there was no mistake made in favor of the boss, and there was'nt a great deal of fear in his mind that he would have to bring his receipt into court.

Well, that was good enough for our grandfathers, but the world moved and brought us to what Chordal has before mentioned, the ordinary weekly book, in which the workmen marked the time made, and the boss filled out the rest of the space, with the amount of money due and paid. There was not much work about that, as I can testify, because I had a hand in that little game once myself. I was furnished with the time book and ordered to keep time. Be it understood, I was superintendent, foreman, time-keeper and pay-master, and the boss kept the books. Now, see how easy it is to keep time in this manner; when a man works you make a mark under the date, when he does not you make none; on pay day I was asked how much money I wanted, and the usual answer, "All I can get," was given. I was furnished with a sum of money, which, of course, always fell short of the amount required. This would lessen the work. I did not have so much to count, and it only took a few minutes on Monday morning to count out the rest.

As far as time-keeper and pay-master was concerned, that was a soft position, but it was too good to last long, and as the *Hawkeye* man says, the sheriff went in partnership with the boss and I had to resign; but it was not my fault that the boss's head was too small to carry all his business.

Now, if any one thinks there is too much work connected with the system given in my last letter, let us see if we can't reduce it by adding another slip. This we will call a time bill, and have it ruled and printed as shown.

TIME BILL OF B. & H. MF'G. CO.

DATE. 187..	Days.	Hrs.	Rate per day.
This is to certify that I have worked.....	5	9	$2.50
For which this bill is rendered			
Total.....	.....	....	$14.75

Recd. payment. (Sig.) J. WILLIAMS.

Used in connection with the daily slip this is to be filled out and handed in the day before pay-day, so as to give ample time to make up accounts to pay off next day. In the first case the time is taken from the slip and transferred to the time sheet, and the clerk has to figure up each man's account at the end of the week, but if the bill be used the man does the figuring, which, of course, saves the clerk so much work, and making fewer bills to file away, the "daily" being merely a certificate to show that the man has put in the amount of time charged for in the bill. In this case there is no danger of either the boss, bookkeeper, or time-keeper making a mistake, and neither of them need be depended upon for a correct report of time. By this you will see, there is no great amount of work to fill out the bill, merely putting down number of days and hours, rate per day, total amount due, date and signature. I guarantee that if the payment of the week's wages depends on the filling out of the bill, be the man ever so ignorant, the bill will be on hand at the

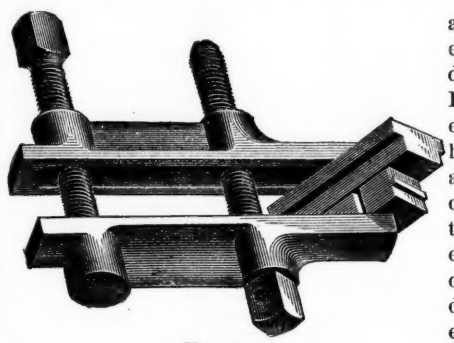


FIG. 5.

appointed time for payment, and that without cost to any one. If this is too long, give your devil a knife and a holiday and he can whittle it down. Respectfully,

GEO. GUNTZ.

Editor American Machinist:

In your issue of 16th inst. appears an article and cards from Mr. Robbins, on the friction of steam in supply pipes, showing a large amount of loss from that source. The pipe, in each case, is unusually long, and the writer omits an important data, viz., whether the pipe was protected or not. I think condensation as well as friction would lessen the pressure.

I recently had an opportunity to test the difference in initial and boiler pressure on a Corliss engine, 18″x 42″, making 70 turns per minute.

The steam pipe is six inches diameter and about twenty ft. long, with two elbows and an angle throttle valve which has an area of twenty square inches, all being protected with a good non-conductor. Steam was taken above the throttle, and the variation in the pressure was three pounds when the engine was cutting off early and was not perceptibly more when running full stroke.

I have taken cards from this engine which showed full boiler pressure, but I think that even the lightest pencil movement indicator will err a few pounds in favor of the initial pressure. The accuracy of the indicator depends wholly *per se* on the weight of its pencil movement. For obvious reasons, when the steam comes suddenly and with considerable pressure under the piston, the pencil is thrown higher than is due to the pressure alone, and the friction of the piston-joints and pencil on the paper *holds* the pencil higher than the pressure alone would do. It is true the same friction retards the pencil in going up, but it can not be taken into account until the spring has balanced the pressure. The circumstances are such that the terminal pressure would be more nearly correct but that the indicator should show even the terminal pressure correctly is absurd. Supposing my idea to be correct, how about that eastern boundary of Mr. Church's cards which have their origin in the terminal pressure? I have some questions to ask on the boundary question, but the "shot gun" spoken of in his last article to the MACHINIST warns me to desist for the present. J. H. DUNBAR.

CLEVELAND, O., Aug. 18, 1879.

The Indicator for Practical Men.

There are a great many practical engine builders who do not use the indicator because to them it is surrounded by mystery and they doubt their own education as sufficient to comprehend it. I do not refer to such fine-haired engines (or their builders) as the Corliss, Buckeye or Wright, but to a cheaper and much more largely sold engine—the average stationary.

Mr. Church and others may make an indicator almost talk; to them the writer has nothing to say, but to those rather who are better practical men than he or them, but poorer mathematicians. The average stationary engine would always perform better if the action of the steam, setting and tightness of the valves, etc., were known to their builders, who, as a general thing, build a very fair engine, so far as material and finish go, set the value as correctly as possible, sell her to some purchaser, and that is the last of her with them. Frequently these engines do well, and as often again are very wasteful.

The builder has a varied reputation; he is aware of this, but cannot explain why two engines, built from the same patterns and drawings, should not produce similar results. He has a vague idea that "there is somethin' er other that would make her show up." He has as much of an intention to buy and apply an indicator as he has of purchasing a Nile crocodile to turn his shop grindstone. Now the truth of the matter is that if he knows enough to make out a bill for work, or fudge out an eccentric's throw on a board, he will do to apply an indicator and improve his engines fifty per cent. He cannot at first go into the upper realms of indicator art, but he can find out so many points by its use of incalculable value to him, that he will soon fall head-over-heels in love with it, and you will find him, after a while, advancing some very hard-headed theories and ideas about "re-evaporation," etc. He can at once ascertain the correctness of the valve setting, if they are rightly proportioned, if more or less lead or compression would be beneficial, if the ports are too contracted, if the valve or piston leaks.

"Re-evaporation" needn't bother him any

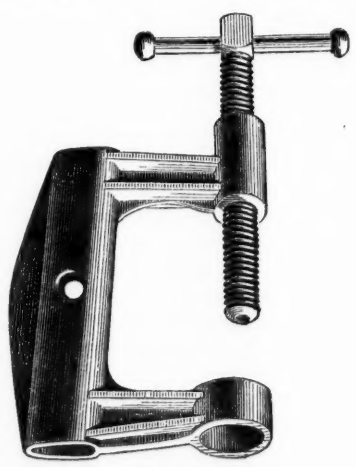


FIG. 6.

for it's too much for the best of them. It's enough for him to know that if the first part of the expansion line approximates the theoretical curve his valves are practically tight, and its running above it at the latter portion is due to "re-evaporation," and that he cannot remedy that. The practical man knows that a valve is not as tight as a bottle at one point, and as leaky as a sieve at another. The theoretical curve based on Mariotte's law is good enough for him, leaving the "adiabatic" for those who can take a diagram easier than they can start a thread for a chaser with a hand tool. The feeding of the horse power is as simple as two and two are four, and by so getting it the practical man will not find himself so far left as he does occasionally when he assumes the mean cylinder pressure, friction, etc., data which the indicator only gives. He can as easily find the "water, as per diagram," but it is of no earthly use to the practical man. The diagram gives what ought to be used, and not what actually is used. Any one who has got at this point by *measuring* the quantity of water put into the boiler, knows that from 50 per cent. to 100 per cent. and over, is used more than the indicator accounts for, and moreover he finds by measuring the water that there is a point of cut-off (averaging 1-5 of the stroke) beyond which a rapid loss of economy results; and that this varies as the pressure varies, the higher pressure affording a closer cut-off.

I started out, Mr. Editor, to show that the indicator to be very useful to man does not require that he possess a college education. In short, any machinist possessing a knowledge of mathematics enough to count correctly his week's wages, if he is engaged in building engines, will find the indicator of incalculable value. In proof of this, I know two of just such men who were engaged in building the commonest form of throttling engines, and only two or three a year at that, who were induced to buy an indicator, and as a result are now building first-class automatic cut-off engines, and have all they can do too. Yours, V. HOOK.

The New York *Tribune*, regarding the scheme which is attracting attention in Paris for a railway from Algiers across Sahara to Timbuctoo, says: "The projectors are two eminent engineers, DuPonchel and Baron Baude. They claim that a route exists over solid ground for the whole of the distance except forty miles, where it would be necessary to erect a timber tunnel road, like the snow sheds along the Central Pacific, to keep the shifting sands of the desert off the track. The estimate cost is $80,000,000. It is claimed that the valley of Higer and the basin of Lake Tschad are surpassingly fertile. The Sahara road would resemble our Pacific road in running for a great part of its length through an arid region, affording no traffic, but instead of reaching at its terminus a large civilized community with a world-wide commerce, it would find only a teeming horde of barbarous blacks, who would have to adopt new modes of life before they could produce a surplus of agricultural products for the road to transport.

A new iron railroad tie recently exhibited at Philadelphia dispenses with the use of spikes, bolts, nuts, or fish plates, and with the drilling and punching of rails, and avoids the consequent dangers of weakening or fracture from such causes. The mode of attachment is by means of a recess, with which each tie is provided, along the bottom of which recess wedge-shaped transverse pieces are cast. At the side of the recesses are two creosoted blocks of wood, which form a cushion and a fulcrum for two clamps, which grasp the flange and web of the rail above, bearing upon opposite faces of the wedge below. By this device the weight of the train increases the grip of the clamps. The first cost of this tie is greater than that of the wooden tie, but it is claimed that this is more than offset by its much greater durability.

At the Midvale Steel Works, at Nicetown, Philadelphia, the Sellers regenerative open-hearth furnace has been torn down, and a 12 ton Siemens-Martin furnace of improved design is being built in its place. The large rolling mill, on which was rolled the steel for the St. Louis bridge, is being repaired and altered, and will probably be used to roll the steel for the superstructure of the East River bridge, the contract for which was taken by the Edgemoor Iron Co., the proprietors of which, the Messrs. Sellers, of Philadelphia, are also interested in the Midvale works. A new product of the Midvale works is steel castings, chiefly of large sizes. These are made of various degrees of hardness, and are remarkably free from blowholes. They make a number for their own use, for rolls for making weldless tires. The other principal specialties of these works are steel axles, tires, gun steel, and merchant steel.

A conference of delegates, representing 200,000 miners, was held in Manchester, England, on August 13th. A resolution was unanimously passed favoring emigration to the United States. If they all come, several of our undeveloped Western mines can be made to increase the wealth of the country.

AMERICAN MACHINIST

PUBLISHED WEEKLY
BY
American Machinist Publishing Co.
HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

Edition, 7,200 Copies.

The American News Company.
Publishers' Agents, New York.

The International News Company,
(Formerly the Willmer & Rogers News Co.)
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.
$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.10 to Foreign Countries, postage prepaid.

ADVERTISING.
Outside page, 35c. per line, each insertion.
Inside pages, 20c. per line, (12 lines one inch.)

EDITORIAL ANNOUNCEMENT.
☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, AUGUST 30, 1879.

CONTENTS.

	PAGE.
The Casting of Small Steam Cylinders. V. Hook...	1
New Double Cylinder Steam Fire Engine.....	2
Automatic Versus Fixed Cut-offs. F. F. Hemenway.	2
Trials of the Hancock Inspirator.....	3
Scraped Surfaces. Chordal.....	4
Improved Hydro-Extractor.....	4
The Steam Engine. Stephen Roper.....	5
Engine Proportion and Construction—Steam and Exhaust Valves.....	5
Flexible Packing Rings.....	5
The Song of Steam..	5
What Constitutes a Good Lathe. L. F. Lyne.....	6
Methods for Keeping Workmen's Time. Geo. Guntz.	6
Improved Machinists' Tools.....	6
The Indicator for Practical Men. V. Hook.....	7
Communication from J. H. Dunbar.....	7
Special.....	8
The Low Wages "Boom.".....	8
A Razor-Hardening Difficulty.....	9
Machine Shop Wages.....	9
Compliments of Our Contemporaries.....	9
Business Specials.....	9
Questions and Answers.....	10
Literary Notes.....	10
Manufactures.....	10
Machinists' and Engineers' Supplies.....	10

The revival of the iron trade in this country has given a start to the pig iron market in Scotland, according to our English exchanges.

Special.

We wish to make the following facts fully understood by our readers:

1st. That nobody has ever paid the publishers of the AMERICAN MACHINIST one cent for anything inserted in its reading columns, either for illustrated descriptions of machinery and tools, contributed articles, editorials, manufacturing notes, book reviews or reviews of shop supplies.

2d. That we never will publish any notice for pay, either direct or indirect, except in our advertising columns.

3d. That no party interested in making or selling machinery, engines and boilers, or in their manipulation has, or ever has had any pecuniary interest in the AMERICAN MACHINIST.

The Low Wages "Boom."

The collection and publication of labor statistics has become the special work of a number of commissions appointed by various State governments, which, during the last two or three years have prepared some interesting and valuable reports. But these reports seldom stop with the plain recital of statistics and comparisons. They are often supplemented by shrewdly worded essays on the folly of discontentment and strikes among workmen, the wasteful extravagance of their methods of living, habits of drinking, and the high wages they receive when the cost of subsistence is considered, compared with some period before the war. The publication and distribution of these reports annually at public expense is supposed to be for the edification of both employer and employed, without endeavoring to disturb the relations that exist between them, i. e., without making an official effort to change rates of wages or systems of employment. We notice, however, that many of these reports seem to be prepared expressly to impress upon workmen the necessity of accepting lower wages or working more hours and living in a plainer way, dispensing with many of the comforts and conveniences they now enjoy.

Whether the issuing of such literature is a legitimate use of the public money must be left to the electors of each State (of which workingmen constitute at least four-fifths), but when the same kind of printed matter, aiming at the same object, is sent out by a department of the United States Government, it becomes the duty of the press and the public to give it a critical review.

The Department of State has just issued a volume embodying the reports from U. S. Consuls on the condition of labor in the several countries of Europe, which are reinforced by some very pointed comments by our Honorable Secretary of State, Mr. Wm. M. Evarts. According to these reports, wages in the United States, in the localities selected for comparison, are double those of England, France, Denmark, and Belgium, and three times those of Germany, Italy and Spain. The prices of the necessaries of life in the United States are set down as lower than in Europe, and in countries where wages are very low, it is stated that the greatest happiness prevails among the working people. The report aims to show that low wages, instead of being an evil, constitute a blessing in disguise, as workingmen when they are obliged to subsist upon small compensation learn habits of economy. Full wages tables are given for the various European countries. Here is a comparison of wages paid in Brussels, Belgium, in a few trades with the same in New York City.

	Brussels.	New York.
Bricklayers	$6.00	12 to 15
Masons	6.00	12 to 18
Carpenters and joiners	5.40	9 to 12
Gas-fitters	5.40	10 to 14
Painters	4.20	10 to 16
Plasterers	5.40	10 to 15
Plumbers	6.00	12 to 18
Blacksmiths	4.40	10 to 14
Bakers	4.40	5 to 8
Cabinet makers	4.80	10 to 13
Tinsmiths	4.80	10 to 14

Then we have a table of the prices of the necessaries of life.

	Brussels. Per pound. Cents.	New York. Per pound. Cents.
Bread	4 to 5	.. to 4½
Beef	16 to 20	8 to 16
Veal	16 to 20	8 to 24
Mutton	16 to 20	9 to 16
Pork	16 to 20	8 to 16
Lard	20	10 to 12
Butter	20 to 50	25 to 32
Cheese	20 to 25	12 to 15
Coffee	30 to 40	20 to 30
Sugar	15 to 20	8 to 10

We are next treated with some of Mr. Evarts' reflections as follows:

"A review of the reports received from Belgium shows that the working people of that country are happy and contented, notwithstanding that their lives are continual struggles for a meager subsistence; that they are frugal and industrious, and live within their means; and that a feeling of reciprocity exists between the employer and employed.

"It is thought that this reciprocity of feeling is made necessary in order to enable Belgium to compete with English, French, and German manufacturers in foreign markets, and thus secure employment for their own workingmen. A few years of misunderstandings between capitalists and laborers, such as periodically convulse England, would paralyze Belgium and ruin both employers and employees. Were it not for this reciprocal feeling which unites labor and capital, Belgium would be scarcely known as a commercial or manufacturing country."

The pith of the above extract may be seen at a glance, but the concluding paragraphs of Mr. Evarts' review of Consular reports are directed point blank to the reduction of workmen's wages all along the line. He dismisses the subject as follows:

"The question which now peremptorily challenges all thinking minds is how to create a foreign demand for those manufactures which are left after supplying our home demands. We cannot stand still, for the momemtum of increase will soon become so great that it will push us outward anyway; to push us safely and profitably is of so much importance as to almost overtop all other public questions of the hour. This question appeals equally to the selfishness and patriotism of all our citizens, but to the laborer it appears with tenfold force, for without work he cannot live, and unless we can extend the markets for our manufactures he cannot expect steady work, and unless our manufacturers can undersell foreign manufactures we cannot enlarge our foreign market. The first great truth to be learned by the manufacturers and workingmen is that the days of sudden fortunes and double wages are gone.

"We must realize the fact that ocean steam communication has annihilated distances and brought the nations face to face. This drawing together of the nations means equalization in trade, profits, wages, etc., the advantage being with those who soonest accept the situation, and show the most sensible continuity in the new paths of success. The Consul at Newcastle-upon-Tyne shows that that city is commercially nearer to New York than to London. If steam communication can thus bring one of the leading cities of a small island like England nearer to New York than to its own capital, it can work equal wonders with the leading seaport cities of all Europe in their commercial intercourse with the seaport cities of the United States. This is a question of great importance to both laborer and capitalist, for it must revolutionize all past theories of trade and commerce, by establishing international equalization.

"In the near future the workingman of New York cannot expect twice or thrice the wages of his fellow-worker in Europe, while all other things—food, rent, clothing, etc.—are on an equality; nor can the coal miner of Pennsylvania expect twice the wages of the Northumberland miner, while coal from Northumberland mines can be landed in New York at less than the price of Pennsylvania coal."

In one point Mr. Evarts is correct—we need to create a greater foreign demand for manufactures, but he makes a serious mistake in assuming that the way to do this is to cut down our workmen's wages to an equality with those of Europe. We have already secured an entry into foreign markets and furnish goods to compete successfully in price and quality with anything turned out in Europe.

What has given us this entry and the wonderfully rapid increase of foreign demand for American manufactures? Clearly, not low wages, for these consular reports show our home wages to be at least double those paid in Europe. We must look for some other reason for our remarkably successful and growing trade abroad. Yet our worthy Secretary of State would have us understand that lower wages is the great desideratum to enable our home manufacturers to compete favorably with those of Europe. If he had made a pilgrimage through the shops and mills of any of our great manufacturing districts, with careful observation he might have discovered the cause of our successful competition abroad. *It exists in the workmen themselves, and is developed by the American system of rewarding labor and invention.* Let us compare the workmen of Europe with those of America. The former, as a class, are pretty clearly shown by the consular reports to be mere drudges, but are "happy and contented," having small hopes of bettering their condition. They are kept down by the meanest wages to such a condition of perpetual poverty that they are enabled to obtain scarcely anything beyond the plainest food, clothing, and shelter. The foreign skilled workmen read books and newspapers very little, least of all those devoted to mechanical subjects. To such a state of menial servitude have they been reduced they feel scarcely a spark of ambition or encouragement to adapt special means to an end, or to improve methods of manufacture. They plod along in the old beaten track "happy and contented," and, as Mr. Evarts might say, "If ignorance is bliss 'tis folly to be wise." Right here is where the American workmen rise head and shoulders above transatlantic members of their craft. They do not exist in abject squalor, nor maintain a constant struggle for the bare necessaries of life, but have means to beautify their homes, dress well, educate their children, and to obtain and read books and newspapers, thus acquiring intelligence and information to advance themselves in their occupations.

Would our scholarly Secretary of State wish to reduce American workmen to the level of the ill-paid, ill-clad, and scantily-fed drudges of Europe? We are very strongly of the opinion that the equalization of wages he expects to see will never be effected. A large number of American mechanics read, study, and experiment outside of working hours. If it is desired to improve the manufacture of some article, or to produce it more cheaply and quickly, the progressive, reading and thinking American mechanic, knowing that his successful efforts will be fairly rewarded, goes to work, devises and builds a special machine to do the work required. This machine is always more or less automatic. The finished product finds its way to Europe, exciting the envy and admiration of their best artisans, and the wonder of all classes how it can be made so cheaply, and so perfectly, in this land of ruinously high-priced labor! An American horse-nail machine was recently exhibited in England, and, judging from the notices we see in our British exchanges, it will take them six months longer to get over their astonishment at the working of this creation of Yankee genius.

As an example of the way in which our home fabrications, turned out by the best paid labor in the world, are made to surpass, both in quality and cheapness, the best results of foreign rivalry, we will instance the manufacture of scissors. In Sheffield, which is supposed to be the focus of this industry, a workman forms the scissors bowl by hammering out a tang to proper length and shape, then bending it oval until the tip touches the bar at the desired point; next making it fast by a careful and difficult weld. This process requires more time and skill than a live Yankee mechanic would care to devote to such a common-place tool; moreover it necessitates considerable grinding in finishing to accurate shape. In Connecticut is a hardware factory where scissors forgings are made in large quantities, but by a radically different process. Steel dies are made to conform to the exact shape of bowl and blade. The flat pieces of steel are heated in a furnace and struck into smooth and accurate scissors forgings as fast as a drop hammer can deliver its blows. A single blow forms a true bowl and blade without the least grinding to shape. When the pieces are removed from the hammer there is a thin burr adhering to the edge where the metal is squeezed between the flat portions of the dies. This is cleanly and perfectly

removed by one stroke of a cutting die, formed to exact shape, which leaves the forgings ready for polishing, sharpening, and riveting together, the last step completing the tool.

This Connecticut establishment receives steel blanks from Sheffield manufacturers, makes tons upon tons of the most accurate scissors forgings, barrels them up and sends them back to the original consignors in the latter city. In due time some of them appear in American hardware stores made into Sheffield scissors! Doubtless the Connecticut workmen get double the wages of the English scissors forgers, but what earthly chance have the latter to compete with the former, with their handiwork in an open market, each party adhering to present methods? The difference in wages is a mere bagatelle compared with the difference in processes, and so it is with hundreds of other special manufactures that have been revolutionized by American mechanical genius, stimulated and supported by a rate of wages that enables a workman to live respectably and devote a share of his energies to improving tools and methods of production.

The foreign artisan has his thoughts and energies so engrossed in his pinching poverty, by a constant struggle to maintain himself and family, that he has neither time, inclination nor encouragement to study improvements. His children follow in the same well-worn track that he has trodden, and along which his ancestors for many generations have passed. He opposes with all his force the introduction of labor-saving machinery, such as has made American mechanical productions cheaper and better than his highest skill is capable of turning out, and has given steady and remunerative employment to a large body of our skilled mechanics in supplying a trade close to his own door. Mr. Evarts apparently sees but one way to compete with the low-priced labor of Europe, viz., "equalization in trade profits, wages, etc." He has, in the volume under notice, committed a serious blunder, which we trust and believe he will in time discover. The tendency is to elevate the American workman and reward him with still higher wages — with a larger proportion of the wealth he creates.

There are many other questions suggested by these Consular reports, but we leave their discussion to a future issue.

A Razor-Hardening Difficulty.

In the recent transfer of a numerous company of Sheffield artisans to our shores, with the view of engaging in the manufacture of razors in this country, according to English methods, a serious and wholly unexpected obstacle has been encountered.

It would seem that there is something in the British air, that is especially favorable to the development of fine sharpening qualities in the matter of grindstones; for it appears that the company of migrating workers in question, adhering to the universal theory prevalent among their fellows in England, resolutely refuse to use any but British grindstones for this class of work. Whether this resolve is in any measure due to the innate fondness of the working classes in England for having their noses continuously and systematically held to the grindstone by the aristocratic governing classes, is a question that would require several pages of our space, at the very least, to discuss with any degree of completeness.

But this is not all; the brief trial of the liquid that temperate Americans have agreed to designate by the term water, which this company of artisans (in the intervals of other beverages) have so far taken the risk of making, has satisfied them that it is wholly unsuitable for hardening razors, and that a proper regard for the traditions of English workshops implies a strenuous demand upon their part for an unstinted supply of British water for this purpose, notwithstanding the consequent necessity of importing it to special order.

Willing to agree to any reasonable terms, in the interest of peace and a successful completion of this experiment, the American employers have urbanely consented to order the construction in England of several large tubs, in which is to be conveyed water from Sheffield, for hardening purposes. But this water cannot possibly last; when it is exhausted, what then?

The well known tendency upon the part of unoccupied water to encourage the propagagation of wrigglers and their subsequent ripening into mosquitoes, renders the accumulation of any very large quantity of this water at any one time, a matter of inconvenience, if not of positive annoyance. In the event of default, then, what is to be used?

The active imagination of the average newspaper philanthropist, however, may probably be relied upon to suggest ways out of this embarrassing dilemma. Whether the grade of fresh milk ordinarily sold, as the pure juice of the cow, by milkmen in any of our large cities, could be relied upon to stop the breach, is not yet known to any certainty, though there is little doubt that the experiment will be tried.

Several tests by individual members of the company of the liquid known in certain sections as apple-jack, were regarded at one time as promising very favorable results, but as it has been shown that the supply of this liquid is small, and depends abnormally upon the market price of apples, the chances for its adoption are less flattering than at first seemed probable.

The most promising substitute for this British water, however, that has yet been named, judging from present indications, is the liquid known to some Europeans and most Americans as lager beer, drawn from the wood, though the eager rivalry among the makers, and the limited capacity of the committee appointed to test the various brands likely to be offered, make any confident statement as yet premature.

But as the original plan pointedly discountenanced the use of steamers as a conveyance for these large tanks or tubs, owing to the greater likelihood of sea-sickness, so to speak, among the animalculæ that abound in British water, and as pointedly favored the project of bringing them over in large and powerful schooners, full rigged for this purpose, it is more than likely that the well-known tendency of American lager beer to disport itself in schooners, will tend strongly to urge the selection of this enterprising liquid henceforth as a substitute for British water in hardening razors.

We have received several letters from machinery establishments in San Francisco and San Jose, Cal., informing us that they had subscribed for the AMERICAN MACHINIST, and paid our agent for the same, but had failed to receive more than one copy. We have no soliciting agent in the Pacific States, and the man who obtained money for subscriptions in the above cities is a fraud. He gave receipts signed with different names. If this scamp shows himself in the places where he has operated, he may expect to be promptly arrested. Our California friends should either send their subscriptions direct to this office, or to some responsible newsdealer.

Machine Shop Wages.

In our inquiries for rates of wages we find an active demand for *first-class high-priced* machinists, iron moulders, boiler makers, blacksmiths, pattern makers, and draughtsmen. The demand for such workmen appears to be greater than the supply, while ordinary mechanics are easily engaged any day. In no instance have we heard a proprietor complain of the rate of wages he is obliged to pay, but complaints are frequent of lack of skill in those claiming to understand their trade. Machinists certainly need to learn the various branches of their business more thoroughly than they do, even at the sacrifice of higher wages for a season. They never will take positions as foremen or extra paid hands until they become familiar with more than one department of the work.

We append rates of wages paid in several shops in Brooklyn, N. Y. The tendency is towards an advance, *beginning with the most skillful, and therefore best paid, craftsmen*.

C. B. Hardick (steam pumps) pays machinists an average of 24⅜ cents an hour. A majority of them receive 25 cents an hour. Men just out of apprenticeship get $2 a day. The best machinists get $3 a day. Blacksmiths are paid 27½ cents an hour, and the engineer $2 a day.

The New York Twisted Drill Co. pay machinists $2 to $3 a day, with an average of $2.50; unskilled men, $1.25.

The Columbian Iron Works pay machinists $2 to $3.25 a day; moulders, $2 to $3; blacksmiths, $2.75 to $3.50; pattern makers, $3 to $4.50; engineer, $2.75.

John Robertson & Co. pay machinists, new comers, $2.50, and the old hands $2.75 and $3 a day; pattern makers, $3.50; blacksmiths, $3.25. They did not reduce the pay of their workmen at any time during the period of industrial depression we have happily passed through.

The Atlantic Steam Engine Works employ a larger force than last winter, and pay machinists $2.12 to $2.50 a day; blacksmiths, $3 to $3.80; pattern makers, $2.50 to $3; boiler makers, $2.12 to $2.25; engineers, $2.25, and ordinary laborers, $1.50.

The Brooklyn Brass and Copper Co., (Rolling Mill) employ fifteen per cent. more men than they did two months ago. They pay skilled hands from $2 to $6 a day, and unskilled hands an average of $1.37½ a day.

Somers Bros. (Fine Metal Goods) employ 14 tool-makers to whom they pay $2.25 to $3.75 a day.

Norman Hubbard (Steam Pumps) pays machinists, new comers, $2, and old hands $2.50 a day; pattern-makers, new, $2.50, old, $3; engineer, $2.

Benton's Pipe Works pay machinists an average of $2.50 a day; blacksmiths, $3; pipe-cutters, $1.30 to $2 a day.

J. Mitchell (Foundry) pays moulders an average of $2.50 a day; laborers, $1.50.

Cornelius & Platt pay machinists $2.25 to $2.50 a day.

James Clayton (Steam Pumps) pays machinists $2 to $2.25 a day; pattern-makers, $2.50 a day.

Smith Bros. (Boiler Shop) pay boiler makers $2.50 a day, average.

At Foster's Steam Pump Works machinists get $2 to $3 a day, with an average of $2.50. Extra good workmen get $19 a week.

Guild & Garrison (Steam Pumps) pay machinists $2 to $3 a day, averaging $2.50; blacksmiths, $3.

Bliss & Williams are building a large new brick shop. They employ 120 men. Regular machinists receive $2.50 to $4.50 a day; die-makers, $2,75 to $4; blacksmiths, $3.50; pattern makers, $3 to $4.

Compliments of our Contemporaries.

From the New York Commercial Advertiser.

The AMERICAN MACHINIST, one of the best of our popular scientific journals, has recently merged from monthly into weekly issue, with great advantage to all concerned. To take such a costly step as this in the face of a dull business season showed confidence in its resources and in its capabilities, which in this case has evidently not been misplaced. Well filled advertising columns and an increasing subscription list are the best evidences of the pursuit of a wise course—so far as newspaper publishing is concerned. The AMERICAN MACHINIST is devoted to the work indicated in its title, but its editorial articles, in particular, are more general than is customary in this class of journals, while the paper is conducted altogether in a way to interest, instruct, and satisfy our intelligent mechanics and others interested in the theory and practice of mechanical science.

From the New York Evening Express.

One of the most ably edited and comprehensive of our mechanical serials is the AMERICAN MACHINIST, which from being a monthly publication has just changed to a weekly. The paper appeals to a very large class of highly intelligent men interested in the arts and manufactures, and has made such progress since its first issue, about two years ago, as to warrent what would seem to be a risky change—the issue of fifty-two numbers a year instead of twelve. It is matter for general satisfaction that there is to be found such a field for this class of journals.

From the Walden (N. Y.) Herald and Recorder.

The AMERICAN MACHINIST, a journal devoted to the interests of machinists, engineers, founders, boiler makers, pattern makers, and blacksmiths, is a weekly publication that every mechanic should have. It is a very handsome and interesting sixteen page journal. Published by the AMERICAN MACHINIST Publishing Co., at 96 Fulton St., New York City, at $3.00 per annum.

From the Red Hook, (N. Y.) Journal.

The AMERICAN MACHINIST has been changed from a monthly to a weekly. It is nicely printed and filled with valuable information to mechanics. It is published at 96 Fulton Street, New York, at $3.00 a year.

From the Mining Record.

AMERICAN MACHINIST. This journal specially prepared for machinists, engineers, founders, boilermakers and mechanics on wood and metals, with the issue of the 28th of June, appeared as a handsome weekly to be published hereafter at 96 Fulton Street, New York. It is a handsomely printed and illustrated paper, well edited for the special ends in view, and we do not doubt, will prove of special value to the mechanical classes for whom it is designed to cater information.

From the Highland Falls (N. Y.) Journal.

The AMERICAN MACHINIST now has a circulation of 7,500 copies and is one of the most instructive and entertaining papers published.

From the Montgomery (N. Y.) Standard.

The AMERICAN MACHINIST has recently been changed to a weekly paper. Each number contains sixteen four-column pages. The matter of the MACHINIST is very instructive to all who are engaged in constructive pursuits, and decidedly interesting to the mass of the reading community. It is highly worthy of liberal support. It is published by the AMERICAN MACHINIST Publishing Company, 96 Fulton Street, New York.

From the Mechanics Falls (Me.) Citizen.

The AMERICAN MACHINIST, a 16-page, 64-column weekly publication, is a journal of real merit, devoted to the interests of machinists, engineers, founders, boiler makers, blacksmiths, and others. Every number is finely illustrated, and contains articles upon all manner of mechanical subjects. The MACHINIST is published in a convenient form for binding, and its preserved numbers would give an interesting history of current inventions and discoveries, so far as mechanical matters are concerned. It should be in the hands of every mechanic and every one interested in machinery.

From the Scientific Record, Washington, D. C.

The AMERICAN MACHINIST, a well-known publication, has met with so much favor among the craftsmen whom it represents that it has been compelled to change its issue from a monthly to a weekly journal. Its active editoral and business corps has also been increased. It is a live paper and of especial value to all interested in machinery.

Business Specials.

Thirty cents a line for each insertion under this head.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1). A. H. G., St. Louis, Mo. writes: I am about to set a tubular boiler 60 in. in diameter, 18 feet long, has 20 flues 6 in. in diameter. I come to you for advice, having great confidence in your ability to advise on such a subject.

I have the same size of boiler in every particular, set now, but I do not think it uses coal economically. My grates are 4 feet long, 21 in. from boiler to grates, space over bridge wall 7 in., space between boiler and flame bed 9 in., space between side walls and boiler 6 in., space between end of boiler and back wall 12 in.

I have a splendid draft. How can I improve this setting, or how shall I set the other boiler to give better results? I use about 35 to 40 bushels of coal per day, running four elevator engines, which I think is too much coal for the work done.

I have about 750 square feet of heating surface as near as I can come at it roughly. I evaporate 4¾ lbs. of water per pound of coal, at an average pressure of 60 lbs. to the square inch. If you will advise me through your questions and answers column how best to set this boiler I will feel very grateful.

P. S. 2. When we read of experiments on boilers, the expression "from and at 212 degrees" in speaking,—Does it mean that the evaporation takes place and continues at that temperature, that is, Does it mean that no pressure accumulates in boiler? A. Your tubes are entirely too large and should be 4 in. in diameter; but if your boiler is built no change can be made in this direction. Space over bridge wall should be 8 in., and the space between boiler and flame bed should be 18 in. Instead of evaporating 4¾ lbs. of water per pound of coal you ought to evaporate 7 lbs. To get better results, choke your draft, by means of a damper, placed in the uptake or chimney near the end of the boiler, apply a pyrometer to the flue between the damper and chimney, and do not allow the heat to escape at a temperature over 400 degrees; if it does there is a loss. The heat should be allowed to pass off at a temperature in excess, and for a boiler pressure of 60 lbs. per square inch, the above recommendation will answer. 2. No, the temperature of steam rises with the pressure, while the temperature of the water remains about the same. If the water were raised to the same temperature as the steam it could not be retained in the boiler.

(2). J. T. T., Sandersville, Ga. writes: There are continual contentions and disputes here about grinding grain. I wish that you would be kind enough to settle the question. 1. Can a 20 in. to 30 in. mill, such as the Queen of the South, Munson's and other small mills, grind as fine corn meal as large mills from 40 in. and upwards on the old style? 2. Which is the most economical, and what are the principal advantages of the small mill, power being equal? Please answer and oblige a subscriber "for life." A. 1. Yes, the small mills will grind as fine up to 15 to 20 bushels per hour, above which a larger mill should be used. 2. The points in the economy of a small mill are, viz.: The first cost, small amount of space occupied. In point of power, the same expenditure of power is necessary to produce the same amount of meal, either on a large or small mill. The stones of the small mill having so much less surface will have to be dressed oftener than the large ones, therefore, for a mill to run constantly, the large mill is the most economical; but, if a mill is only required to run a small portion of the time, the small is the most economical.

(3) D. M. C., Harlem, N. Y., writes: Wishing to ask a question, I take the liberty to write this note, hoping that I will see it in next week's paper. Question is, what wheels must I put on a lathe to cut 13 threads to the inch. The screw on the lathe is 3 threads to the inch. The wheels that I have are 18, 24, 30, 36, 42, 48, 66, 96, 120. Numbers indicate teeth in wheels. What rule is the best to work on? A. There are no gears in your list which will cut the thread that you desire, supposing your lathe to be single geared. The following rule will enable you to find the required gears, of which there are a number. Rule for single geared lathe: Divide the number of threads you wish to cut (to the inch) by the pitch (number of threads to the inch) of the feed screw, and multiply the quotient by the number of teeth on the driving wheel, and the product is the number of teeth on the wheel driven. For double geared lathe. Rule: Divide the number of threads you wish to cut by the pitch of the feed screw, and multiply the quotient by the product of the number of teeth on the driving wheels, then any divisor that leaves no remainder to this product is the number of teeth on one of the wheels driven, and the quotient the number of teeth on the other wheel driven.

(4) F. D. L., Rochester, Minn., writes: I wish to ask you a question in regard to the scope of a patent. A certain patent was granted in June, 1858; in June, 1872, it was extended for seven years, and thereby expired in June, 1879, having run twenty-one years. Now, does that patent become public property? Can any one use it who wishes? I understand that the parties claim to have had a further extension, or rather, that it passed the House last session, but did not get through the Senate. Now, in case that during next session it should pass the Senate, will all articles manufactured between June, 1879, and the time of passage be compelled to pay royalty to the owners of patent, or will they be free from all claims? A. The invention does become public property. The grant of an exclusive right for fourteen years was the price the public paid for its full exposure in the patent. The grant of an extra seven years was a special grace accorded on account of peculiar hardships. It is certainly and positively public, and it is the privilege of the public to use and enjoy it after the extended term has expired. There is little chance of any patent being extended a second time by special act of Congress. In the possible case that after being public property from last June till next winter, or till some other Congress, this invention shall again be covered by a special extension of the patent it will certainly be conditioned that all the machines or goods made in the interim shall be free, and that the extended patent shall only apply to what shall thereafter be sold. This was the condition on which the James Goulding patent of 1826 was extended in 1862, after having been public property eight years. No bill can pass for a special extension after expiration which does not have a saving clause to protect the work already in use by the public. The above opinion is advanced by the well-known patent expert, Thomas D. Stetson, of this city.

LITERARY NOTES.

A TREATISE ON THE USE OF BELTING FOR THE TRANSMISSION OF POWER with numerous illustrations of approved and actual methods of arranging main driving and quarter twist belts, and of belt fastenings. Examples and rules in great number for exhibiting and calculating the size and driving power of belts; plain, particular and practical directions for the treatment, care and management of belts; descriptions of many varieties of belting, together with chapters on the transmission of power by ropes, by iron and wood frictional gearing; on the strength of belting leather, and on the experimental investigations of Morin, Briggs and others, for determining the friction of belts under different tensions, which are presented clearly and fully, with the text and tables unabridged. By John H. Cooper, M. E., octavo, cloth, $3.50. Published by Claxton, Remsen & Haffelfinger, 624, 626 & 628 Market St., Phil., Pa.

The above work, containing 310 pages, has been adopted as a text book on the subject of which it treats, and contains a very valuable collection of information and data in reference to experiments on the use of belting. The author has placed the cornerstone of this treatise upon his own experiments, and, as such, is thoroughly practical. As we have remarked heretofore, the most useful part of scientific literature is that in which the explanations given are in plain, simple language, such as every one will clearly understand. During the Centennial Exposition of 1876, what made the deepest impression upon the minds of our foreign visitors was the use of belting for the transmission of power.

Previous to the publication of this book every manufacturer had his own formula for the amount of belt surface to be allowed to transmit a horse-power, which varied from 34 to 400 square feet, each one of the manufacturers falsifying these figures to advance his own interest.

The author has carefully selected the most valuable portions from the experiments of Towne, Morin, and others, besides giving his own rules and formulas for calculating the width, strength, and power of all kinds of belting, carefully observing to give due credit to those whose opinions he has borrowed.

The translation of Morin's paper on the variation of the tension of leather belts is also embodied in this work, the transmission of power by the use of ropes, embracing an article from the French, by Achard, besides Wicklin's method of transmitting power by frictional gearing. The work is amply illustrated, and furnishes a vast amount of information gathered from sources not easily accessible, particularly outside of large cities. It seems to be a compilation of all the best papers that have been written on the subject of belting, and is very exhaustive. To say that it is free from mistakes would be superfluous, and we ask: Where is the book that has none?

These mistakes are few, and the book as a whole, is one that could not be easily replaced. It is a great advantage to have the various experiments of different authors on belting collected in one volume, for which this work deserves success. We have placed it in our list of books for a Machinist's Library, as a plain, practical book. The general arrangement of the work is very creditable to both the author and publishers, and should be in every library.

We take pleasure in commending *The Era*, published weekly, by Frank H. Norton, 29 Broadway, N. Y., to those among our readers, who desire to be well posted about what is going on, not in New York merely, but throughout the world, without the labor of wading through many papers.

The editor, Mr. Norton, is a good observer and a clever writer, with capable assistants, and is making just the paper that intelligent people should appreciate. The news of the week is summarized in each number, not in jerky paragraphs, but in readable shape, as a special feature, while current topics of thought, trade, and literary, dramatic and social happenings and tendencies are discussed in a bright and attractive way. *The Era*, under its new management, deserves success, and from its appearance we think is getting it. The subscription price is $2.00 per annum, with liberal inducements to parties forming clubs.

MANUFACTURES.

Omaha, Neb., is moving for the establishment of city water works to be operated by a pumping engine.

The Indianapolis water-works are pronounced a perfect failure.

Fort Wayne, Ind., is again working up the water-works question.

Such has been the waste of water in New York City, the Commissioner of Public Works requires all persons using water for business purposes to use a meter by which the amount they must pay the city can be gauged. This is to check waste rather than to increase the revenue. The elevated railroads use half a million gallons of water a day.

Clark, Reeves & Co, of Phœnixville, Pa., have been awarded a contract for the building of three miles of bridge work for the government of Chili, South America, to be completed within two years.

A meeting of the provisional directors of the New Brunswick Sugar Refining Company was held at St. John, N. B., on the 4th inst., at which the Secretary was authorized to open subscriptions for stock, and take the necessary steps to perfect organization.

Notice is given in the *Canada Gazette* of application for letters of incorporation for the Stormont Cotton Manufacturing Company with a capital stock of $150,000, and chief place of business at Cornwall.

The Hartford Carpet Company have begun work on a new building, 115 feet long by 40 feet wide, for their Brussels department, at Thompsonville, Conn.

Business is brisk in the brass shops at Haydenville, Mass. Some 230 men are employed in this branch of industry.

Frick & Company, of Waynesboro, Pa., builders of the Eclipse Farm and Portable Engines, are operating their works from 6 A. M. to 9 P. M. They now build the Eclipse Traction Engine, which gives excellent satisfaction.

Flather & Co., Nashua, N. H., write us: So far this year we have had orders so far in advance of what we could possibly supply, that we have been afraid to ask for more. The Nashua industries are nearly all as busy as possible, but we do not hear of any new business houses or much enlargement at present.

The stove moulders in Albany, N. Y., have struck for 20 per cent. advance in wages.

Rutland, Vt., proposes an extension of its water supply.

Brooklyn, N. Y., water department will spend $219,600 this year.

Iowa City will establish water works, if the necessary stock can be sold.

Mr. C. R. Waterhouse is driving spiles for the foundation of a large addition to the manufactory of Sargent & Co., at New Haven, Conn. An addition to the works of the New Haven Folding Chair Company is progressing, and is about half completed.

The puddlers employed by the Glasgow Iron Company, Pottstown, have had their wages increased from $3.75 to $4 per ton.

The Beaver Falls (Pa.) *Courier* states that an Ohio firm is about to establish works in that place for the manufacture of a superior quality of iron.

The Hampshire Paper Company will put up a new machine shop and stock house, and add a new tower and elevator to their South Hadley Falls mill.

The Rhode Island Locomotive Works, in Providence, are full of work. Among the orders on hand are some from the Chicago & Western Michigan, the St. Louis, Kansas City & Northern, and the Chicago, Milwaukee and St. Paul. An order from the Detroit, Grand Harbor, and Milwaukee has just been filled.

The Reading Hardware Company have raised the pay of their molders fifteen per cent.

The Fall Mountain Paper Company at Bellows Falls are about to erect a new mill.

Engineers' and Machinists' Supplies.

Trade remains good for this season of the year, better than it has been in August for some years past. The tendency of prices is upwards. The Hancock Inspirator Co. have just issued the following price list of lifters or ejectors manufactured by them:

	Gallons per hour.	Price.
No. 10	120	$10 00
" 15	300	15 00
" 20	540	25 00
" 25	900	30 00
" 30	1260	35 00
" 35	1740	40 00
" 40	2230	50 00
" 45	2870	60 00
" 50	3480	70 00
" 55	3600	75 00
" 60	4000	80 00
" 65	4500	85 00
" 70	5220	90 00
" 75	6000	95 00
" 100	10620	100 00
" 110	12900	110 00
" 120	15360	120 00

The capacity of these machines is estimated with a 4 foot lift, and 60 lbs. steam. With a greater lift, the capacity will be proportionately reduced.

A single tool monitor attachment for the live spindle of a lathe (attached same as a chuck) has made its appearance, but we have as yet no particulars of its operation.

Wm. Main, Piermont, Rockland Co., N. Y., has just placed upon the market a new Fluting and Gear Cutting Attachment for lathes, patented July 15th, 1879. Dealers in machinists' supplies in this city have the attachment for sale at $12.

The Seibert Cylinder Oil Cup Co., through their agent, Frank S. Lynch, 34 Vesey street, N. Y., report that an early advance in the price of some sizes of their oil cups is in contemplation.

H. H. Thompson, 34 Vesey St., N. Y., is introducing a new patent rubber step, designed for use in railway and street cars, steamboats, carriages, houses, etc. The steps are furnished of any size, and with or without metal edge.

The Nason Manufacturing Co., 71 Beekman St., N. Y., have notified their customers that the discount on plain and galvanized wrought iron pipe has been advanced to 57½ per cent. from the list prices of March 15, 1876.

Wm. Cooke, successor to Cooke & Beggs, 6 Cortland St., N. Y., has issued a new illustrated catalogue and price list of machinists' and railway tools. Among other specialties, the book contains descriptions of Roots' blowers, the Keystone Injector, Pond's tools, a new wrought iron turn table for locomotives, Whitehill's engines, and a great variety of supplies for the use of engineers, machinists, and master mechanics.

The Jos. Dixon Crucible Co., Jersey City, N. J., have been doing a good thing. They have brought a pencil sharpener, which will really sharpen a lead pencil.

Situation Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

WANTED.—A good mechanical draughtsman, accustomed to steam engine and mill work. Call on Wm. Munger, 503 First Avenue, City.

USEFUL BOOKS
FOR
PRACTICAL MEN.
DESCRIPTIVE CATALOGUE FREE.
E. & F. N. SPON, 446 Broome Street, N. Y

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
"Slim" Saw Files.
"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders,
Vise File Holders.
Stub Files and Holders.
Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.

NORTON'S

Solid Emery and Corundum Wheel.

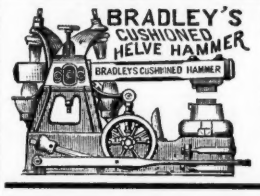
The Best Solid Wheel in use. Will not Glaze, Heat, nor smell, and will run equally well, Wet or Dry.

SATISFACTION GUARANTEED OR NO PAY.

F. B. NORTON, Patentee and Manufacturer,
No. 41 Water Street, Worcester, Mass.

W. S. MIDDLETON,
BROKER IN
Railroad, Mining and Steamship Supplies,
MACHINERY, HARDWARE AND TOOLS
of every description.
52 JOHN STREET, NEW YORK.

☞ Manufacturers of Machinists', Engineers', Railway and Mining Supplies of every kind are requested to send me their latest catalogues and trade prices.



Has More Good Points,
Does more and Better Work.
Takes Less Power,
than any Hammer in the world.
BRADLEY & COMPANY,
Syracuse, N. Y.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y.
83 Water Street, Boston.

THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

STEAM PUMPS—Duplex and Single Cylinder.

PRICE LIST ISSUED JAN. 1, 1879, WITH A REDUCTION EXCEEDING 30 PER CENT.

WATER METERS. OIL METERS.

H. PRENTISS AND COMPANY

Manufacturers of PATENT RELIEVED
Machinists', Blacksmiths' and Gas Fitters'
Taps; Dies, Reamers and Screw Plates, &c., &c.
DEALERS IN MACHINISTS' SUPPLIES.
No. 14 DEY STREET, - NEW YORK.

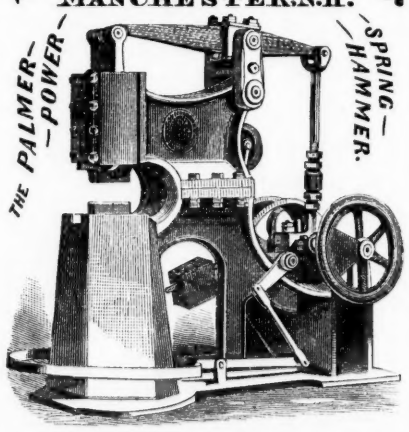
PUBLISHERS' NOTICE.

The steady demand for back numbers of the AMERICAN MACHINIST, from parties who desire them to complete their files, has exhausted our supply of the numbers mentioned below. We will give the amounts named, respectively, for each copy sent us that is clean and fit for this purpose.

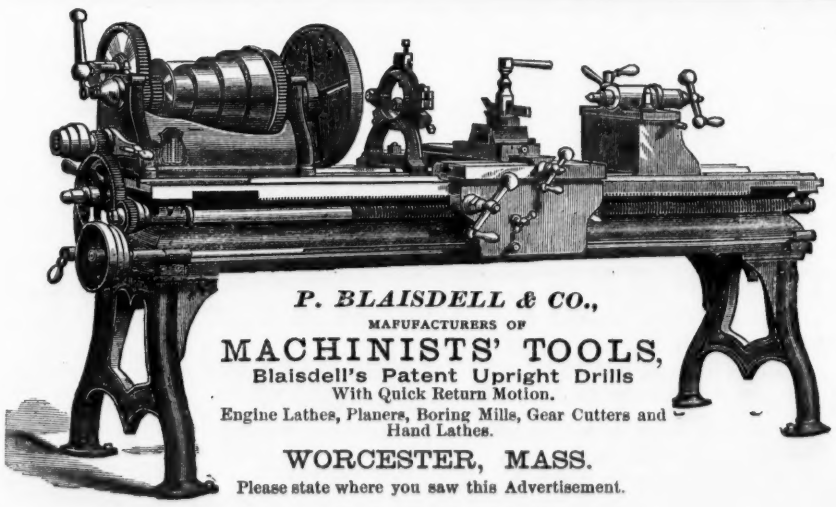
No. 1, Vol. 1 (November, 1877),	each,	$1.00
No. 3, Vol. 1 (January, 1878),	"	.50
No. 4, Vol. 2 (February, 1879),	"	.25

American Machinist Publishing Co.
96 Fulton St., N. Y.

S. C. FORSAITH & CO.
MANCHESTER, N.H.



BOLT FORGING MACHINES,
POWER HAMMERS,
Machinists', Blacksmiths' Tools,
And Wood-Working Machinery
A SPECIALTY.



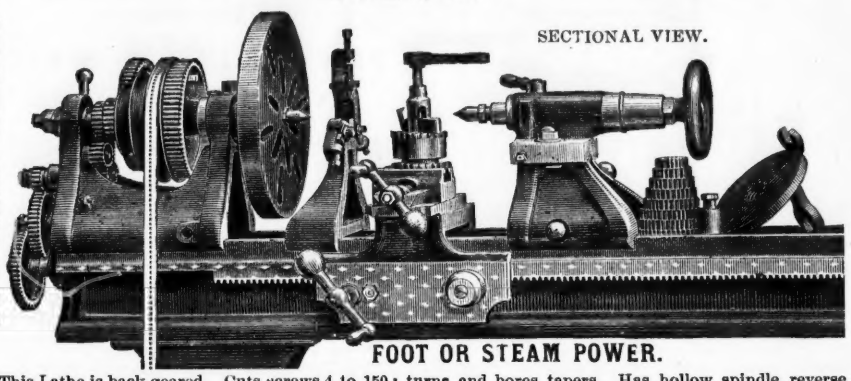
P. BLAISDELL & CO.,
MAFUFACTURERS OF
MACHINISTS' TOOLS,
Blaisdell's Patent Upright Drills
With Quick Return Motion.
Engine Lathes, Planers, Boring Mills, Gear Cutters and Hand Lathes.
WORCESTER, MASS.
Please state where you saw this Advertisement.

Barnes' Patent Foot and Steam Power Machinery.

LATHES, SCROLL SAWS, CIRCULAR SAWS, FORMER, TENONING AND MORTISING MACHINES, Etc.

ENGINE LATHE No. 5. PRICE $100.

SECTIONAL VIEW.



FOOT OR STEAM POWER.

This Lathe is back geared. Cuts screws 4 to 150; turns and bores tapers. Has hollow spindle, reverse feed, back rest. Swings 9x34 inches. Workmanship and material first-class in every respect. We will deliver on board ship, in New York City, machinery ordered to foreign ports. Descriptive catalogue sent FREE.

Address W. F. & JOHN BARNES, ROCKFORD, ILL., U. S. A.

JARVIS PATENT FURNACE

FOR SETTING

STEAM BOILERS.

Economy of Fuel, with increased capacity of Steam Power.
The same principle as the SIEMENS' PROCESS OF MAKING STEEL, *i. e.*, utilizing the waste gases with hot air.
Will burn all kinds of waste fuel without a blast, including screenings, wet peat, wet hops, sawdust, log-wood chips, horse manure, &c.

A. F. UPTON, General Agent.

"Also Agent for the Mahony Patent Corrugated Grates, with 50 per cent. air space."
Send for Circular. *P. O. BOX 3401, BOSTON, MASS.*

STEEL CASTINGS

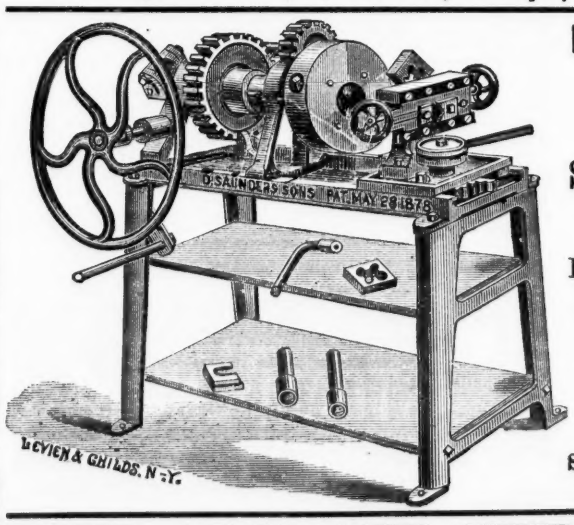
FROM 1-4 TO 10,000 lbs. WEIGHT.

True to pattern, sound and solid, of unequaled strength, toughness and durability.
An invaluable substitute for forgings or cast iron requiring three-fold strength.
Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc.
12,000 Crank Shafts of this steel now running proved superior to wrought iron.
CRANK SHAFTS, CROSSHEADS and GEARING specialties.
Circulars and Price Lists free. Address
CHESTER STEEL CASTINGS CO.
Works, CHESTER, Pa. — 407 Library St., PHILADELPHIA.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED.

As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as:—PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc. CATALOGUE and PRICE LIST, on application.

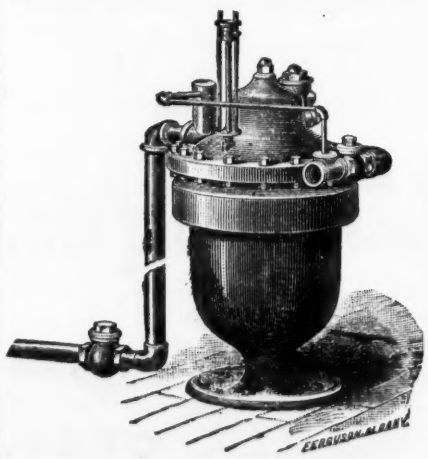
500·NORTH·FIFTEENTH·ST·PHILADELPHIA.

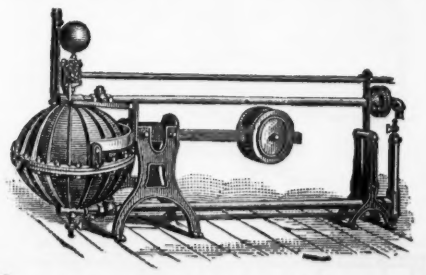


D. SAUNDERS' SONS,
Yonkers, N.Y.,
Manufacturers of
Steam and Gas Fitters'
TOOLS,
Pipe Cutting & Threading
MACHINES
For Pipe Mill Use, &c.,
A SPECIALTY.

Send for Circular, and say where you saw this advertisement.

THE ALBANY STEAM TRAP.

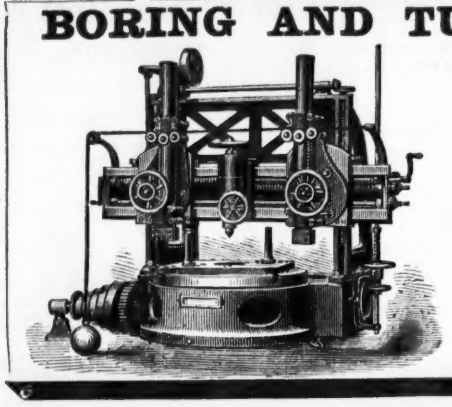




This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes.

Apply to
Albany Steam Trap Co.
ALBANY, N. Y.

BORING AND TURNING MILLS.



All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

PATENTED IMPROVEMENTS.

New Patterns.

MACHINISTS' TOOLS,

The Latest and Best, at very moderate prices.

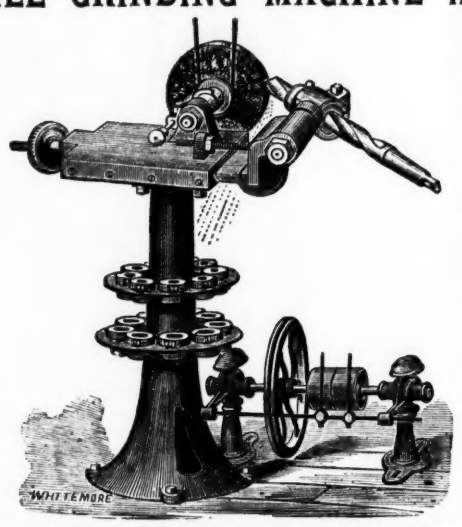
NILES TOOL WORKS,
HAMILTON, OHIO.

WM. H. EDDY,

WORCESTER, Mass.

Manufacturer of the Best and Cheapest

TWIST DRILL GRINDING MACHINE in the World.



☞ Requires no skilled workman to run this machine. Either Crooked or straight drills ground quickly and accurately.

This Machine grinds drills to the same shape as the best machinists do by hand. It enables the operator to make the cutting edge or lip of the drill thick and strong so it will not crumble away in drilling, also to make the lip true with the twist or outside surface

☞ Send for Prices and Testimonials.

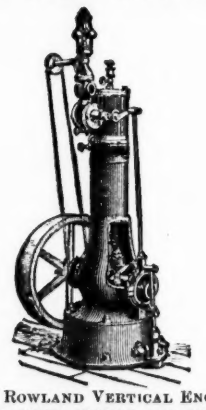
THOS. PROSSER & SON,

15 Gold St., NEW YORK.

"Prosser" Boiler Tube Expanders

STEEL SCREW PUNCHES, TUBE BRUSHES, &C.

Vertical and Yacht Engines.



The Rowland Vertical Engine.

LARGE WEARING SURFACES.

Simple in Construction. Reasonable in Price.

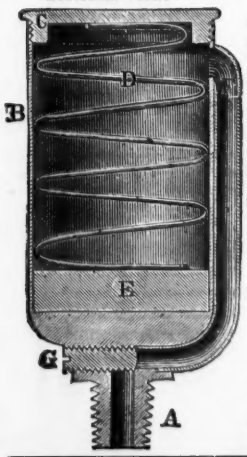
Send for Circular.

F. C. & A. E. ROWLAND, Engineers,

NEW HAVEN, Connecticut.

Loose Pulley Lubricator.

Sectional View.



The only reliable automatic Loose Pulley Oiler in the World.

Saves Oil, Belting, Machinery, Time, soiling of Fabrics, &c., &c. Will run from one to three months with once filling. Gives general satisfaction.

For illustrated description see April issue of American Machinist, 1879, or send for circular. Address

Loose Pulley Lubricator Mf'g Co.

P. O. Box 1030.

MIDDLETOWN, CT.

ENGRAVING ON WOOD

D. H. TUTTLE
5
BEEKMAN ST.
N.Y.

Mechanical work a Specialty.

FOR AUTOMATIC CUT-OFF
FIXED CUT-OFF & SLIDE-VALVE

STEAM ENGINES

ALSO BOILERS ADDRESS
WOODBURY BOOTH & PRYOR, ROCHESTER, N.Y.

JAMES W. SEE,

Consulting Engineer,

HAMILTON,

OHIO.

Newell's Patent Universal Grinder.

IMPORTANT TO MILLERS, MINERS AND MANUFACTURERS.

This Grinder is offered to the public as a machine which has no equal for grinding grain or pulverizing quartz, phosphates, bone, cement, oyster shells, scraps, glue, fire clay, and other articles of similar nature. It is unrivaled in the amount of work it will do in any given time and in the economy of power used. It is a point of great merit that our mill delivers a perfectly ***GRANULATED*** article. In grinding grain the meal ***IS NOT HEATED,*** and consequently may be bagged at the delivery spout with no danger of fermentation, and without the loss of weight incidental to the product when heated in grinding. It is estimated that the usual shrinkage is sufficient to cover the entire expense of grinding by this mill. We have ground, bolted for fine feed, through 13 mesh, weighed and bagged up ***six thousand five hundred (6500) pounds of corn per hour*** with not more than 15-horse power. It is compact, portable and not expensive. A cordial invitation is extended to all parties to call and see the machine at work at

Foot West 19th Street, New York City.

NEWELL & CHAPIN.

Park Benjamin's Scientific Expert Office,

37 PARK ROW, NEW YORK.

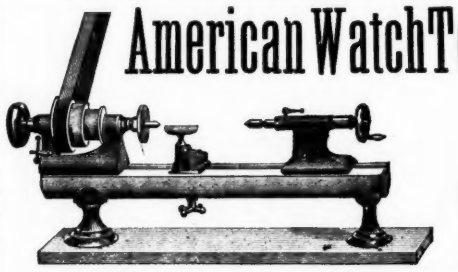
Testing, Designing, Construction and Selection of Machinery.
Expert, Mechanical and Scientific Evidence in Law Suits.
Editing and Publication of Trade Literature and Scientific Works.
Expert Advice on Inventions and on all Scientific and Mechanical Subjects.
Engravings, Chemical Analyses, Assays.

PARK BENJAMIN, Ph. D.
Editor Appletons' Cyclopædia of Applied Mechanics; late of Scientific American.

GEO. H. BENJAMIN, M. D.,
Business Manager.

Assisted by a Corps of Experts in all Branches of Science.

American Watch Tool Co., Waltham, Mass.



MANUFACTURERS OF

MACHINERY

FOR

Watch and Clock Making,

AND

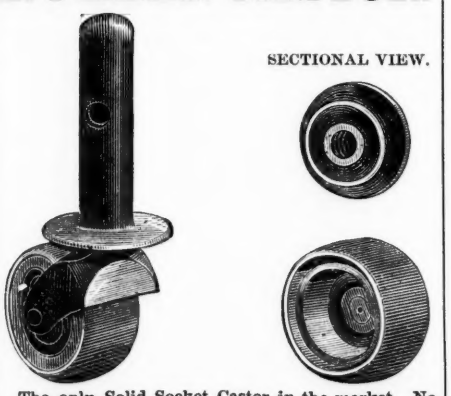
Special Tools and Machinery of all kinds.

The accompanying cut shows our No. 3, or Machinist Bench Lathe. This lathe was originally designed for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland. All agree in pronouncing it the best lathe for small work ever made.

GEORGE P. CLARK,

Manufacturer of the Patent

RUBBER CASTOR.



SECTIONAL VIEW.

The only Solid Socket Castor in the market. No more noise. No more marking of inlaid floors. Save your carpets by using the Rubber Castor. Warranted perfect in action. Also one of the best non-conductors for Rheumatism. Want to be used to be appreciated. Once tried always liked.

GEORGE P. CLARK, Windsor Locks, Ct.

FRASSE & COMPANY,

SOLE AGENTS,

62 Chatham Street,

P. O. Box 4627. NEW YORK.

TOOL DEPOT. SMALL TOOLS, LATHES &c FOR MACHINISTS, CARPENTERS AMATEURS & EVERY BRANCH OF MECHANICAL TRADE. SEND FOR CATALOGUE. TALLMAN & McFADDEN. PHILADELPHIA.

WONDERFUL

PUNCHING.

D. L. KENNEDY'S

Spiral Shearing Punch.

THE

DRILL

AND REVOLVING CUTTER

SUPERSEDED,

AND THE WORK

2½ TONS PER SQUARE INCH

Stronger than with the Flat Punch.

Can be used in any Punching Machine, by license from the patentee.

D. L. KENNEDY,

10 Cortlandt St., New York.

CAUTION.—Infringements will be rigorously prosecuted.

PATTERN AND BRAND LETTERS.

PRICES REDUCED.

VANDERBURGH, WELLS & CO.

Printers' and Engravers' Warehouse,

Corner Fulton and Dutch Sts.,

NEW YORK.

ROPER'S

Practical Hand-Books for Engineers.

Hand-Book of Land & Marine Engines,	$3.50
Hand-Book of the Locomotive . . .	2.50
Hand-Book of Modern Steam Fire Engines	3.50
Cathechism of Steam Engines . . .	2.00
Use and Abuse of Steam Boiler . . .	2.00

The above books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire and Marine. Any of them will be sent by mail, free of postage, on receipt of publication price. To any one ordering a full set, a liberal discount will be made, and if on examination the purchaser does not consider them worth $50.00 the money will be refunded.

Information by letter, when asked for, will be heerfully given to parties making inquiries about cientific Books, Steam Engines, Boilers, Steam umps, Injectors, or any kind of Steam Machinery.

Address,

STEPHEN ROPER,

Mechanical Engineer.

447 North Broad St., Philadelphia.

Address P. O. Box 2187.

PIERSON & CO.

Office 24 Broadway, N. Y.

Established 1790.

IMPORTERS AND DEALERS IN IRON AND STEEL OF EVERY DESCRIPTION,

Warehouse, 24 and 26 Broadway, and 77 and 79 New Street,

PRICE LISTS FURNISHED ON APPLICATION.

WEEKLY REVIEW.

NEW YORK, AUGUST 23D, 1879.

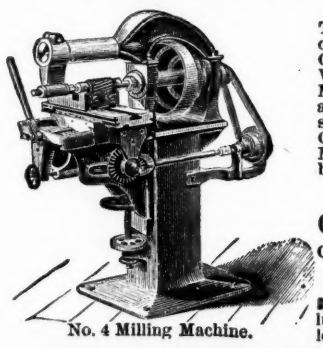
Things are still lively in the iron supply market. The prices of Sheet, Hoop, Shell, Flange, Tank and Boiler Iron are on the up grade, having advanced about ¼c. recently. The mills are sold a couple of months ahead, and there seems to be no doubt that these prices will be maintained, if not further advanced. Hot Polished Shafting is advanced from 1 to 2c. per lb., according to size.

We append prices out of store: No. 1X Pig Iron, $19.50 per ton; Iron Rails, $42.00 to $44.00 per ton, according to weight; Old Rails, $25.00 to $26.00 per ton; Fish Plates, $2\frac{2}{10}$c. per lb.; Railway Spikes, $2\frac{3}{4}$c. per lb.; Bolts and Nuts, $3\frac{1}{2}$c.; Common Iron, $2\frac{1}{10}$c. basis from store; Refined, $2\frac{3}{10}$c. basis; Ulster, $3\frac{1}{2}$c. basis; Machinery Steel, 5c.; Best Tool Steel, 12c.; Norway Bar Iron, $4\frac{3}{4}$c.; Norway Shapes, $5\frac{1}{4}$c.; Nail Rods, $5\frac{1}{2}$c.; Sheet Iron, 3c.; Angle Iron, $2\frac{6}{10}$c.; Tee Iron, 3c.; Band Iron, $2\frac{6}{10}$c.; Hoop, 3c., up; Horse Shoe, $3\frac{2}{10}$c.; Tank, 3c.; C No. 1, $3\frac{1}{4}$c.; C H, No. 1 Shell, $3\frac{1}{2}$c.; Best Flange, 5c.; Boiler Rivets, $3\frac{1}{2}$c. per lb. Hot Polished Shafting in lengths two feet and longer, from 6c to 8c. per lb., according to size. Small Black Rivets, 50% off in papers, 35% off in bulk.

PIERSON & CO., 24 BROADWAY.

FOR MACHINISTS' AND BOILER MAKERS'
HEAVY
Steel Clamps,
Send for Circular to
C. W. LeCount, South Norwalk, Ct.

E. E. GARVIN & CO.
Manufacturers of
Milling Machines, Drill Presses,

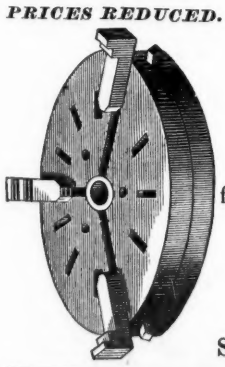


No. 4 Milling Machine.

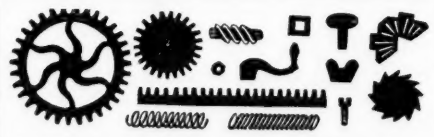
Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters, all shapes and sizes. Gear Cutting and Milling in all its branches.
139-143
CENTRE ST.
Cornell's B'ld'g
NEW YORK.
☞Send for illustrated Catalogue.

THE HENDEY MACHINE CO.
WOLCOTTVILLE, CONN., U. S. A.
MANUFACTURERS OF THE
Manville Patent Iron Planers and Shapers.
24 in. Shapers, 15 in. Shapers, 5 ft. x 24 in. Planers, 3½ ft. x 16 in. Planers, 24 in. Amateur's Hand-Planers, with Chuck and Centers, 3 ft. x 8 in. Fine Engine Lathes, 5 ft x 12 in. Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck and Common Clock Lathes.
☞Send for Catalogue giving description of Tools, with names and opinions of users, and mention where you saw this.

OFFICE OF
The E. HORTON & SON CO.
PRICES REDUCED.



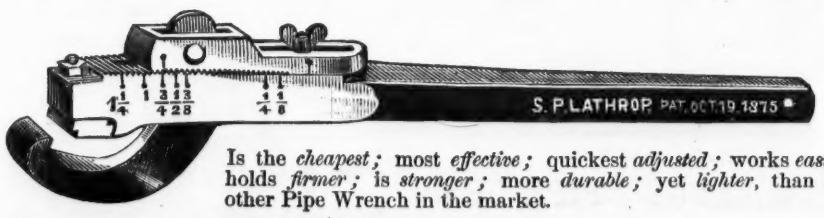
WINDSOR LOCKS, CONN.
APRIL 1st, 1879.
From this date a discount of 30 per cent. will be made from the price list of our Lathe Chuck.
Soliciting your orders, we are .
Yours respectfully,
THE E. HORTON & SON CO.
Send for Price List.



Small Tools of all kinds: GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'ton St., Boston, Mass.

PATENTS.
HENRY E. ROEDER,
304 Broadway, New York.
ESTABLISHED 1852.
Patents procured in the U.S. & Europe.

PRICES REDUCED.
THE VICTOR PAT. ADJUSTABLE PIPE WRENCH



Is the *cheapest;* most *effective;* quickest *adjusted;* works *easier;* holds *firmer;* is *stronger;* more *durable;* yet *lighter,* than any other Pipe Wrench in the market.
EVERY WRENCH GUARANTEED.
No. 1 Wrench takes from 1-8 to 1¼ Pipe.
PRICE $3.00, NET.
S. PARK LATHROP,
200 MARKET STREET, - - - NEWARK, N. J.

Engines Indicated and Examined.
POWER MEASURED.
W. H. ODELL, Practical Engineer.
P. O. BOX 274, YONKERS, N. Y.
N. B.—The application of the "Indicator" to an Engine (by an Expert) instantly detects any waste of power, or defect in the CONSTRUCTION or MANAGEMENT OF THE SAME, and often leads to a great saving of fuel.

JOHN ADT,
20, 22, 24 and 26 Artisan St., New Haven, Ct., U. S.
Automatic Machines,
For Straightening and Cutting Wire of all Sizes to any Length.
Automatic Machines for cutting and forming wire in various shapes. Send for circulars.

NOTICE!

The following original articles, by twenty of the best mechanical authors in the U. S., appeared in the AMERICAN MACHINIST of the dates mentioned below. Copies containing these articles can be ordered from any newsdealer at 6 cents each.

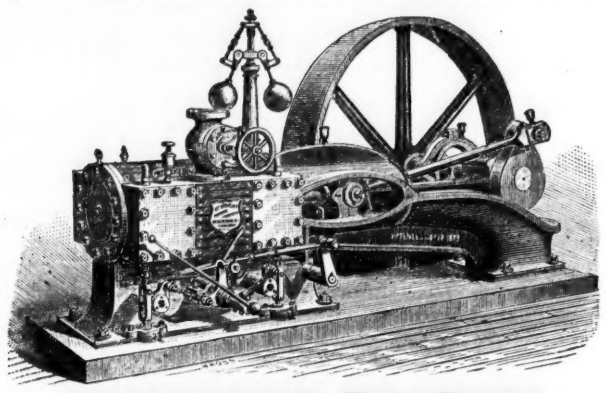
Sizes of Safety Valves.
Prof. R. H. Thurston. December, 1877.
Methods of Setting Boilers in Brick-Work.
Theron Skeel. December, 1877.
Boiler Explosions.
Stephen Roper. April, 1878.
Strength of Steam Boilers.
John W. Hill. July, 1878.
The Properties of Water.
John W. Hill. August, 1878.
Balancing Pulleys.
Geo. M. Chordal. August, 1878.
Piston Speed of Engines.
Wm. Lee Church. September, 1878.
Composition of Fuel.
John W. Hill. September, 1878.
To Prepare a Shaft Properly for Turning.
J. J. Grant. October, 1878.
Practical Method of Setting the Valves of a Locomotive.
L. F. Lyne. November, 1878.
Boring Locomotive Cylinders.
L. F. Lyne. December, 1878.
Grinding and Polishing Metal Surfaces by Hand.
Thos. Hagerty. December, 1878.
To Turn a Shaft Properly.
J. J. Grant. December, 1878.
Engineering Popularized.
Wm. Lee Church. January, February, March, April, May, June 28 and July 19, 1879.
Calculated vs. Actual Engine Duty.
W. H. Odell. January, 1879.
Advantages of High Speed Engines.
Charles T. Porter. August 9, 16, and 23, 1879.
Engine Duty and Indicator Cards.
Chas. A. Hague April, 1879.
Steam Engineering.
Chas. A. Hague. June 28, August 2, 1879.
Extracts from Chordal's Letters.
In every issue since July, 1878, except that of February, 1879.
Defects in Building Engine Lathes.
Prof. John E. Sweet. June 28, 1879.
Use and Abuse of the Engine Lathe.
L. F. Lyne. June 28, 1879.
Steam Engine Cut-Offs.
Stephen Roper. June 28, 1879.
Our American Mechanical Engineers.
No. I. Portrait and Biographical Sketch of Wm. Sellers. June 28, 1879.
No. II. Portrait and Biographical Sketch of Wm Wright. July 12, 1879.
Continuation of Injector Experiments.
Wm. J. Williams. July 5, 1879.
To Bore and Turn a Pulley Properly.
J. J. Grant. July 5, 1879.
Correct Engine Duty.
W. H. Odell. July 5, 1879.
The Engineer.
Stephen Roper. July 12 and August 2, 1879.
Concerning Steam Fire Engines.
R. Grimshaw. July 12, 1879.
Use of the Ratchet Drill.
L. F. Lyne. July 12, 1879.
The Expert.
Stephen Roper. July 19, 1879.
A Novel Centering Device.
Prof. John E. Sweet. July 19, 1879.
Engine Proportion and Construction.
Wm. H. Hoffman. July 26 and August 2, 1879.
Priming—Its Cause and Remedy.
J. O. Buerk, M. E. July 26, 1879.
The New Musical Steam Whistle.
L. F. Lyne. July 26, 1879.
Is the Indicator a Miracle?
Herman T. C. Kraus. August 2, 1879.
Remodeling Valve Motions.
V. Hook. August 2, 1879.

Patent Automatic Cut-off Steam Engine.

WM. WRIGHT,

PATENTEE AND BUILDER, NEWBURGH, N. Y.

THE MOST ECONOMICAL IN THE USE OF FUEL, THE SIMPLEST IN CONSTRUCTION, AND ALTOGETHER THE BEST CUT-OFF ENGINE IN THE MARKET.



COMPOUND ENGINES

For City Water Works; also for Manufacturing purposes, etc. (*Highest duty guaranteed.*)

MARINE AND STATIONARY ENGINES.

STEAM BOILERS AND TANKS,

LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS,&c.

A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

THE "BROWN"

AUTOMATIC CUT-OFF ENGINE,

MANUFACTURED ONLY BY

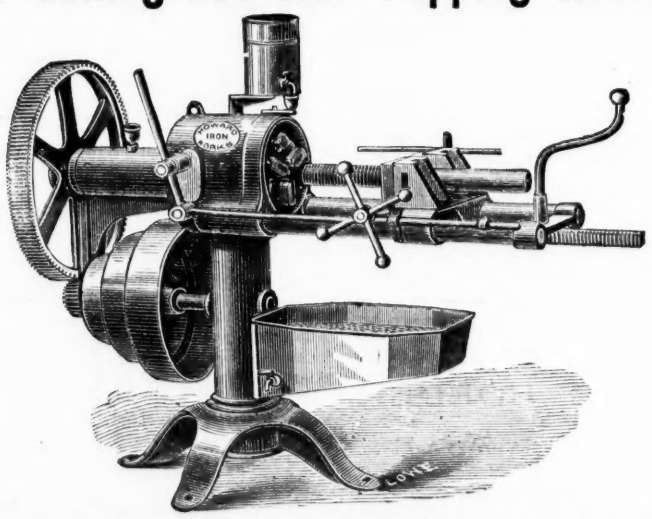
C. H. BROWN & CO.

FITCHBURG, MASS.

SCHLENKER'S

Screw Cutting and Nut Tapping Machines,

Seven Different Sizes.



Send for Illustrated Catalogue.

The Most Simple, Rapid, Strong, Durable, Powerful, Accurate, and Has More Good Points than any other Bolt Cutter in the World.

HOWARD IRON WORKS, Buffalo, N.Y.

MIDVALE STEEL WORKS,

NICETOWN, PHILADELPHIA.

Manufacturers of all Kinds of

Hammered and Rolled Steel,

BEST WARRANTED CAST STEEL

For Machinists' Tools, Taps, Punches, Dies, Drills, Chisels, Shear Blades and Granite Drills.

ALSO,

Machinery, File, Fork, Hoe and Spring Cast Steel.

Address A. M. F. WATSON,

General Sales Agent.

Warehouse, 12 North 5th Street, Philadelphia.

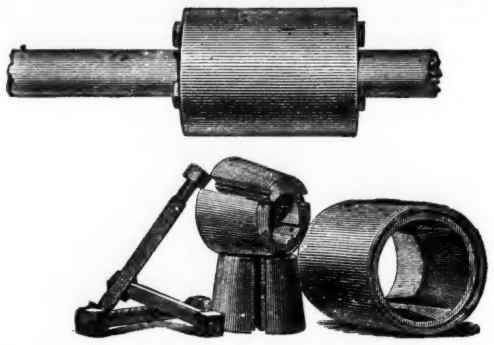
ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, Etc.



Lathes, Planers, Drills, Shapers. Bolt Cutters, Etc.

Railway Turntables and Pivot Bridges,

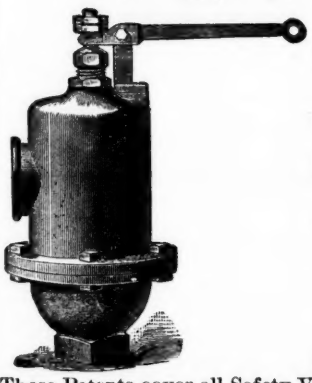
GIFFARD INJECTORS. SELLERS' IMPROVEMENTS

NEW PATTERNS. SIMPLE, EFFECTIVE.

New York Office, 79 Liberty Street.

The Consolidated Safety-Valve Co.

51 and 53 Sudbury Street, Boston.

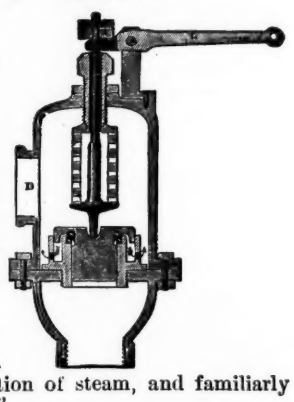


Capital, $100,000.

CHAS. A. MOORE,
Pres. and Gen'l Manager.
MARTIN LUSCOMB,
Treas. and Secretary.
GEO. W. RICHARDSON,
Superintendent.

Sole Owners of all Safety-Valve Patents granted to

E. H. ASHCROFT, Boston, Mass.
AND
GEO. W. RICHARDSON, Troy, N. Y.



These Patents cover all Safety-Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety-Valve."

☞ *Purchasers, beware of infringements of our Patents.* ☜

THE

TRADE GODDARD MARK

Goddard Emery Wheel,

E. A. GODDARD,

Gen. Sales Agent.

ALSO AGENT FOR

AMERICAN TWIST DRILL CO'S

Emery Grinders.

DEALER IN

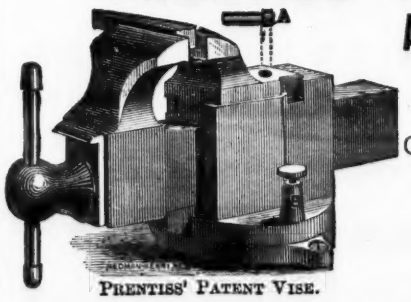
MACHINISTS' SUPPLIES.

Warerooms, 176 FULTON STREET, NEW YORK.

PRENTISS' PATENT VISES.

Adjustable Jaw, Stationary AND SWIVEL BOTTOM.

Complete without Attachments. Adapted to all classes of vise work.

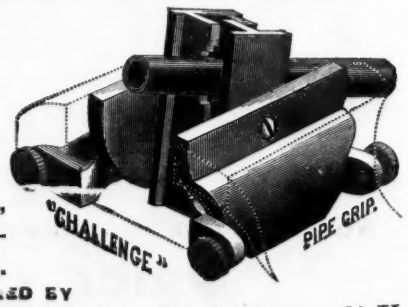


PRENTISS' PATENT VISE.

"CHALLENGE" PIPE GRIP.

ADJUSTABLE (*PAT.* 1879),

Enabling operator to hold Pipes, Couplings, Thimbles, &c., in a Vertical, Slanting, or Horizontal position.



MANUFACTURED BY

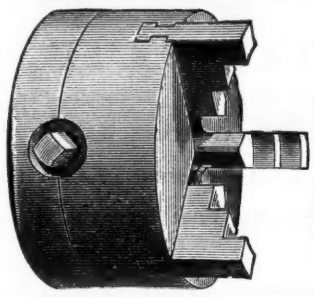
BAGLEY & SEWALL, General Machinists, Watertown, N.Y.

FOR

HALL MANUFACTURING CO.

Send for Circular. 23 DEY STREET, N. Y.

Amateur Geared Chucks



IMPROVED.

2½ in. Diam., price $5.50. 2¼ in., $5.00.

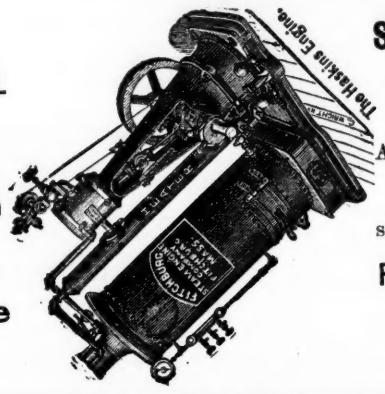
Made with extra Jaws for $1.00 per set. The Jaws, Scroll and Pinions are forged steel. Workmanship first-class and warranted. Hole through the Chuck ⅝ in. Also, the **BEST** all Steel Drill Chuck in the world 0 to ⅝ths. List price, $5.00. Address the manufacturer,

A. F. CUSHMAN, Hartford, Conn.

HORIZONTAL.
VERTICAL
Automatic Cut-off

ENGINES.

Yacht Engines,
Semi-Portable Engines.



STEEL AND IRON BOILERS.

All sizes to 225 horse-power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

A PRACTICAL TREATISE
ON THE
COMBUSTION OF COAL,

Including Descriptions of various Mechanical Devices, for the Economic Generation of Heat by the Combustion of Fuel, whether SOLID, LIQUID, OR GASEOUS.

BY
WILLIAM M. BARR.

1 Vol., large 8vo., illustrated.
Price, Extra Cloth, - - - - - $2.50
" Half Morocco, - - - - 3.50
Sent, postage paid, to any part of the United States upon receipt of the price. Address
JOHN BROTHERS, Publishers, Indianapolis, Ind.

A NEW BOOK.

Friction AND Lubrication.

Determination of the laws and coefficients of Friction by new methods and with new apparatus, by ROBERT H. THURSTON, A. M., C. E., Professor of Mechanical Engineering at the Stevens Institute of Technology; Member of the American Society of Civil Engineers; American Institute of Mining Engineers; Fellow of N. Y. Academy of Science, etc., etc.

The author of this book has long been a student and independent investigator of the laws of friction, and of the effects of lubrication and different kinds of lubricants, and has aimed to present here a complete abstract of existing knowledge on the subject.

He discusses at length, and with such illustrations as are necessary:

Rolling Friction on Roads and Railroads; Frictional Resistance of Railroad Trains; Friction of Cordage, Fluids, Journals, Brakes. Rails, Belts, Pump Pistons, Mill Shafting, etc., etc.; Morin's, Coulomb's Ammonton's, Rennie's and other experiments; Lubrication and the different kinds of Lubricants in use, their characteristics, composition and effects; Limits of Pressure; Size of Journals and methods of oiling them; Testing Lubricants; Identification of Oils, their classification, composition, alterations of composition, mixtures, specific gravity, density, effects of heat, gumming, drying, etc., etc.; Impurities of Mineral Oils; Oleography, cohesion figures; Chemical tests; General Methods of Analysis; Preparation and use of Re-agents; Reactions; Metcalfe's Experiments; Methods of Testing Lubricants; Thurston's Apparatus and Experiments; Friction under varying pressure and with varying velocities; Commercial value of Lubricants and many other kindred subjects.

The book contains many tables for ready reference, and engravings of the different kinds of testing apparatus.

Price, postage prepaid, $1.50. Published and for sale by

THE RAILROAD GAZETTE,

73 Broadway, New York.

☞ Send for Catalogue of Railroad Gazette Publications.

Forged & Twisted Machinists' Drills.

By an improved process of manufacture warranted to do more work than any other drill in market with less liability to injury.

N. Y. TWISTED DRILL CO.
240 Plymouth St., Brooklyn, N. Y.

LARGE AND FRESH STOCK
—OF—

Second-Hand Tools.

PRATT & WHITNEY CO. TOOLS.

ALL GOOD AS NEW.

One Hand Lathe, 15 in. x 8 ft.
One Upright Drill, 24 in. with bk. gear and self feed.
One No. 0, 2 Spindle Drill.
Two No. 0, 3 " "
One No. 1, 3 " "
One No. 2, 4 " " 2 Spindles geared for heavy work.
One No. 1, Power Milling Machine.
Two No. 2, or Lincoln Pattern Milling Machine.
One No. 2, Hand Milling Machine.
One Cutter Grinder.
One No. 2, Screw Machine. Plain.
One No. 2, " " wire feed.
One Screw Slotting Machine.
One Double Cam Cutting Machine.

WOOD, LIGHT & CO.'S TOOLS.

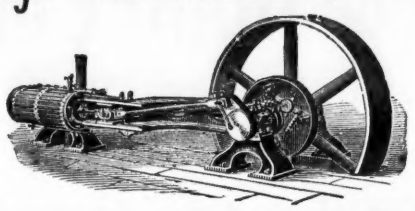
Four 20 in. x 8½ ft. Engine Lathes, bk. geared, screw cutting, rod feed, gib rest, face plate, countershaft.
One 18 in. x 10 ft. ditto.
Three 18 in. x 8½ ft. "
Four 16 in. x 8 ft. "
Six 16 in. x 6 ft. " (W't rest).
One 16 in. x 6 ft. " (Gib rest).
One 16 in. x 5½ ft. " (W't rest).
One 16 in. x 10 ft. Gib rest, rod feed, (not screw cutting).
One 24 x 24 in. x 6 ft. Planers, down, cross and angle feed in the head.

[Works.
One Engine Lathe, 20 in. x 12 ft. Lambertville Iron
One " " 18 in. x 10 ft. Star Tool Co. New.
One " " 18 in. x 9 ft.
One " " 16 in. x 8 ft. Fifield, new.
One " " 16 in. x 5 ft. Good order.
Two " " 14 in. x 4½ ft. Putnam Mch. Co.
One " " 7 in. x 38 in. Ames.
Hand Lathes, from 7 to 15 in. Swing.
One Planer 48 x 48 in. x 16 ft. Good order.
One " 30 in. x 7 ft.
One " 30 in. x 7 ft., new. Stover.
One " 26 in. x 6½ ft. Putnam.
One " 16 x 3 ft., good order, Pratt & Whitney.
One Crank Planer, 24 in. stroke.
One " " 12 " "
One Shaping Machine, 8 in. stroke. N.Y.S.E.Co., new.
One Wood & Light Milling Machine.
One Brainard Milling Machine, No. 8.
Seven Lincoln Pattern Milling Machines.
One Smith & Garvin No. 3. Miller. New.
Two Pond's Index Milling Machine.
One Smith & Garvin Hand Milling Machine.
Two 4 spindle Drills. Ames Mf'g. Co.
Four Sensitive Drills, drills to 3-16 in. hole.
One 20 in. Upright Drill.
One 2-Spindle Profile Machines.
One Suspension Drill. Bk. Geared, Self-Feed.
One Sellers' Bolt Cutter. Cuts to 1¼ in.
One Rotary Shear for sheet metal.
One 1500 lb. Steam Helve Hammer for Axles.
One Axle Centering Machine.
One 300 lb. Ferris & Miles Steam Hammer.
One Bement Hor. Boring Mill.
One 7 in. x 12 in. Whitehill & Smith Engine.
One 10 H.P. Baxter Engine.
One 2 " "
Lot of Stephens Vises, good as new.

E. P. BULLARD,

14 Dey Street, New York.

The Buckeye Automatic Cut-off Engine.

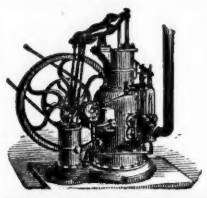


Estimates Furnished on Application.

BUCKEYE ENGINE CO.

Room 42, Coal and Iron Exchange, New York.

HILL, CLARKE & CO., - - - 36 & 38 Oliver Street, Boston.



AIR ENGINES.

NO WATER.
NO ENGINEER.

No Extra Insurance! Absolutely Safe! Simple! Reliable! Durable! Most Convenient and Economical Power Known.

SHERRILL ROPER AIR ENGINE CO.
Manufacturers of Air Engines, Elevators and Hoisting Machinery.
91 & 93 Washington St., N. Y.

The George Place Machinery Agency

Offer for sale all the second-hand tools of the Wood & Light Machine Co., at their Works; also a number of new tools made by them at very low prices; also a large assortment of new and second-hand tools and machinery in stock. SEND FOR A LIST.

The George Place Machinery Agency,

121 Chambers & 103 Reade Sts., New York.

DOWNER'S

Anti-Incrustation Liquid

FOR THE PREVENTION AND REMOVAL OF SCALE IN STEAM BOILERS,

Is a Chemically Scientific Preparation,

SAFE, EFFECTIVE AND ECONOMICAL.

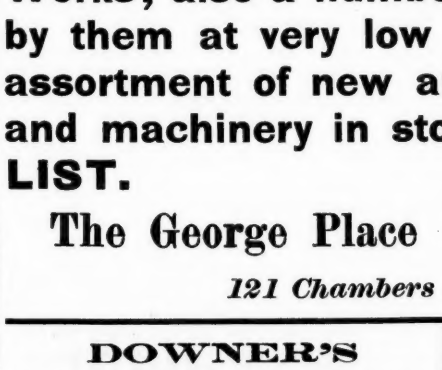
Used in new or clean boilers scale cannot form, as scale-producing constituents are neutralized.

IN BARRELS AND HALF BARRELS.
Circulars on application.

A. H. DOWNER,
(Proprietor and Sole Manuf'r.)
17 PECK SLIP, N. Y.

BINDERS FOR THE

American Machinist.



We are now prepared to offer to our readers who wish to preserve files of the paper, the **MONITOR BINDER**, shown in the above cut which we have selected as the best one offered to the public. The price for neat cloth covers, to hold 52 numbers (1 year), with the name **American Machinist** stamped on the front (outside), will be $1.00 each, mailed post paid in the United States and Canada, and 75 cents each delivered at our office.

American Machinist Publishing Co.

96 Fulton Street, N.Y.

MOORE'S "UNIVERSAL ASSISTANT AND COMPLETE MECHANIC," enlarged edition, contains 1016 pages, 500 Engravings, 461 Tables, over 1,000,000 Industrial Facts, Calculations, Processes, Rules, Trade Secrets, &c., in every Occupation. A $5 book free by mail for $2.50, worth its weight in gold to any Mechanic, Farmer, or Business man. *Agents Wanted.* One Agent reports only one refusal in obtaining 85 orders. An ad. is utterly inadequate to describe the work. For Ill. Pamphlet send stamp to H. Moore, No. 30 Cooper Inst., New York.

Worcester Boiler Works,

MANUFACTURERS OF THE

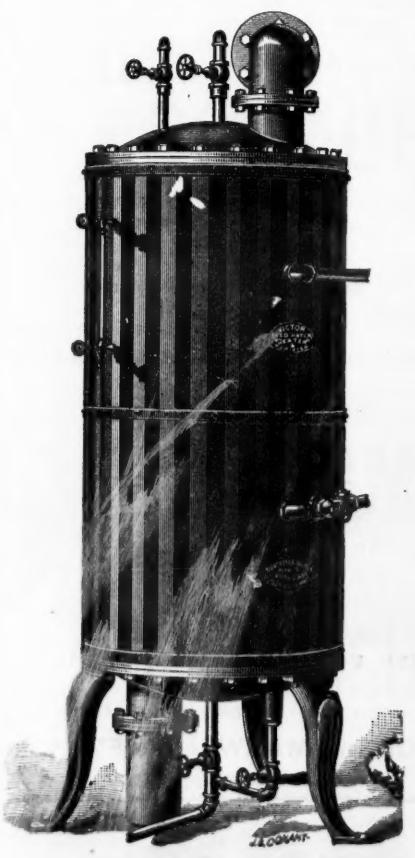
"VICTOR"

Feed-Water-Heater and Purifier,

FOR

HEATING AND PURIFYING WATER

FOR STEAM BOILERS.



(Jones' Patent, Nov. 6, 1877.)

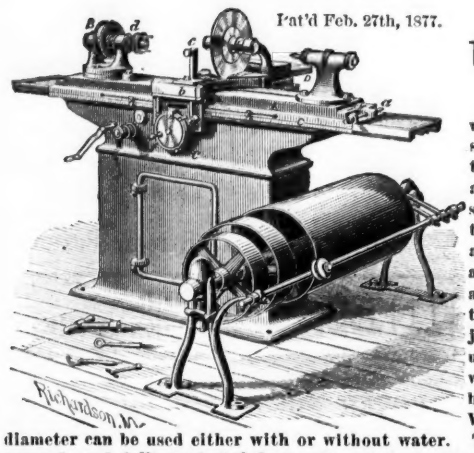
WM. ALLEN & SONS

WORCESTER, MASS.

☞ Write for prices and further information.

BROWN & SHARPE MFG. CO.

Providence, R. I.



Pat'd Feb. 27th, 1877.

MANUFACTURERS OF THE

Universal Grinding Machine.

This Machine is arranged for doing a large variety of operations of grinding, by the use of solid emery or corundum wheels. An additional movable table, capable of adjustment by a tangent screw and graduated arc, admits of straight and curved taper grinding with the centers of the machine always in line. It is specially adapted for grinding soft or hardened spindles, arbors, cutters, either straight or angular, reamers and standards; also for grinding out straight and taper holes, standard rings, hardened boxes, jewelers' rolls, &c. The work can be revolved upon dead centers or otherwise. The grinding wheel can be moved over the work at any angle, by which means any taper can be produced. Wheels from one-quarter inch to twelve inches in diameter can be used either with or without water. The feed works and slides of the machine are covered, and fully protected from grit and dust. The grinding of taper holes and angular cutters is provided for with graduated arcs. A special chuck, for holding work for having holes ground, accompanies each machine. The spindle and boxes of the machine are of cast steel hardened and ground. Distance between centers, 28 inches; will swing 12 inches diameter.

MACHINE TOOL WORKS,

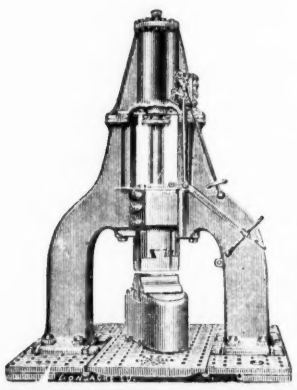
FORMERLY

FERRIS & MILES,

Twenty-fourth & Wood Streets,

(Take Arch or Vine Street Car),

FRED'K B. MILES, Engineer. PHILADELPHIA.



STEAM HAMMERS, DROPS, &c.

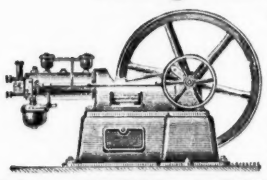
Having recently introduced many valuable and novel improvements into the construction of Steam Hammers and Drops, we are now prepared to furnish these machines in greater perfection than has been hitherto possible. Our new balanced Valve enables more work to be done with less steam and with no appreciable wear. Our new method of adjustment prevents all the side play and lost motion, which is so destructive to such machinery, while the facility of handling is made such as to eclipse all previous efforts in this direction.

Write direct, we employ no agents!

FRED'K B. MILES.

NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.



STARTED INSTANTLY BY A MATCH, IT GIVES FULL POWER IMMEDIATELY.

WHEN STOPPED, ALL EXPENSE CEASES.

No Explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running. Recommended by Insurance Companies.

UNSURPASSED IN EVERY RESPECT for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc.

2, 4 and 7 H. P. and upwards. Built by

SCHLEICHER, SCHUMM & CO., 3045 Chestnut St., Philadelphia.

Established 1866.

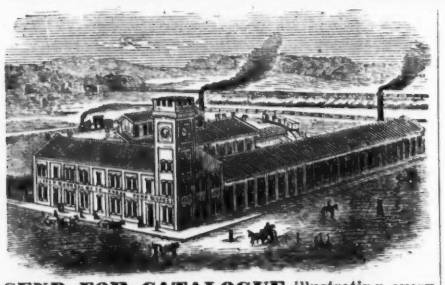
THE FAMOUS HUNTOON STEAM GOVERNOR

INSURES A DIRECT SAVING IN STEAM OF FROM 10 TO 20 PER CENT. OVER ANY OTHER GOVERNOR KNOWN, WHILE FOR QUICK AND ACCURATE REGULATION, GREAT DURABILITY AND LASTING ECONOMY IN USE, THIS IS FAR IN ADVANCE OF ALL OTHERS.

Largely in use by U. S. Government, also by leading Manufacturers in all classes of Work.

Circulars mailed on application to

HUNTOON GOVERNOR CO., Lawrence, Mass.



SEND FOR CATALOGUE illustrating every variety of

STEAM PUMPING MACHINERY.

COPE & MAXWELL MF'G CO.

HAMILTON, OHIO.

Machines at reduced prices, and Wheels *Guaranteed.*

LEHIGH VALLEY EMERY WHEEL CO.

Send for our new Illustrated Catalogue *Weissport, Penn.*

GEO. W. FIFIELD,

Manufacturer of

ENGINE LATHES

From 16 to 48 inch Swing.

Cuts, Photographs and Prices furnished on application.

LOWELL, MASS., U. S. A.

THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,

HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

In connection with their business of

MACHINISTS' TOOLS, GUN, SEWING MACHINE and Special Machinery, &c.

PRICE LISTS FURNISHED ON APPLICATION.

THE BILLINGS & SPENCER CO.

CHAS. E. BILLINGS, Pres't and Sup't.
L. H. HOLT, Treasurer.

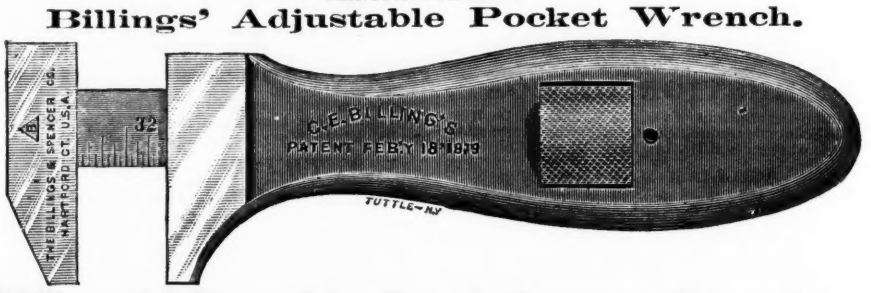
TRADE B MARK.

E. H. STOCKER, Secretary.

HARTFORD, CONN., U. S. A.

MANUFACTURERS OF

Billings' Adjustable Pocket Wrench.



Billings' Adjustable Tap & Reamer Wrenches,

PATENT SCREW PLATES AND DIES,

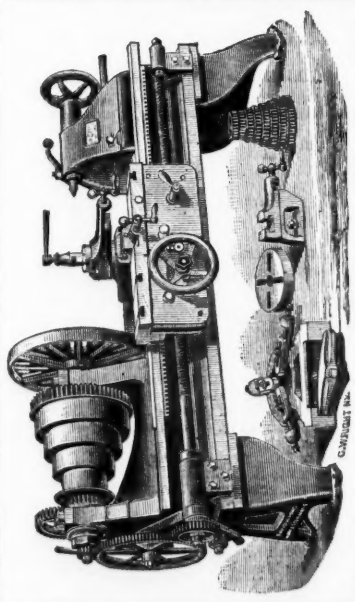
WROUGHT IRON AND STEEL, DROP FORGED LATHE DOGS, SCREW DRIVERS, AND SOLID FORGED SEWING MACHINE SHUTTLES. Also, PACKER RATCHET DRILLS, BARWICK WRENCHES, &c., and all descriptions of

STEEL AND IRON DROP FORGINGS

For Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery Generally. Send for Illustrated Catalogue and Price List.

Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.



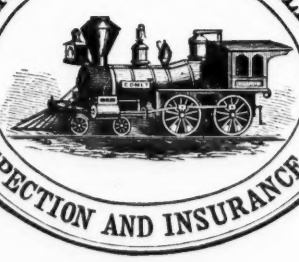
Engine Lathes, Planers, Drills, &c.

DAVID W. POND,

WORCESTER, MASS.

Send for Catalogue of New Designs.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

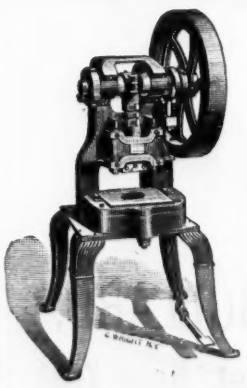


J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

GOLD MEDAL AWARDED PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

MANUFACTURERS OF ALL KINDS OF

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

167 to 173 Plymouth St., cor. Jay, Brooklyn, N. Y.

Catalogues in English, French and German sent on application, in which prices are computed in Dollars, Pounds, Francs and Reichsmarks.